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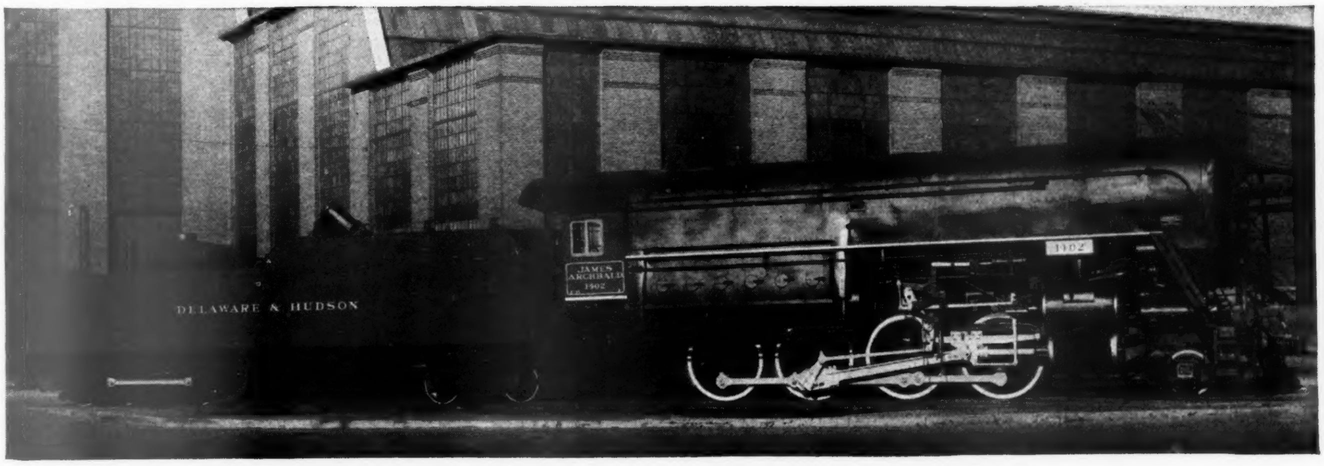


High-pressure locomotive built for the Delaware & Hudson by the American Locomotive Company

D. & H. Procures Third High-Pressure Locomotive

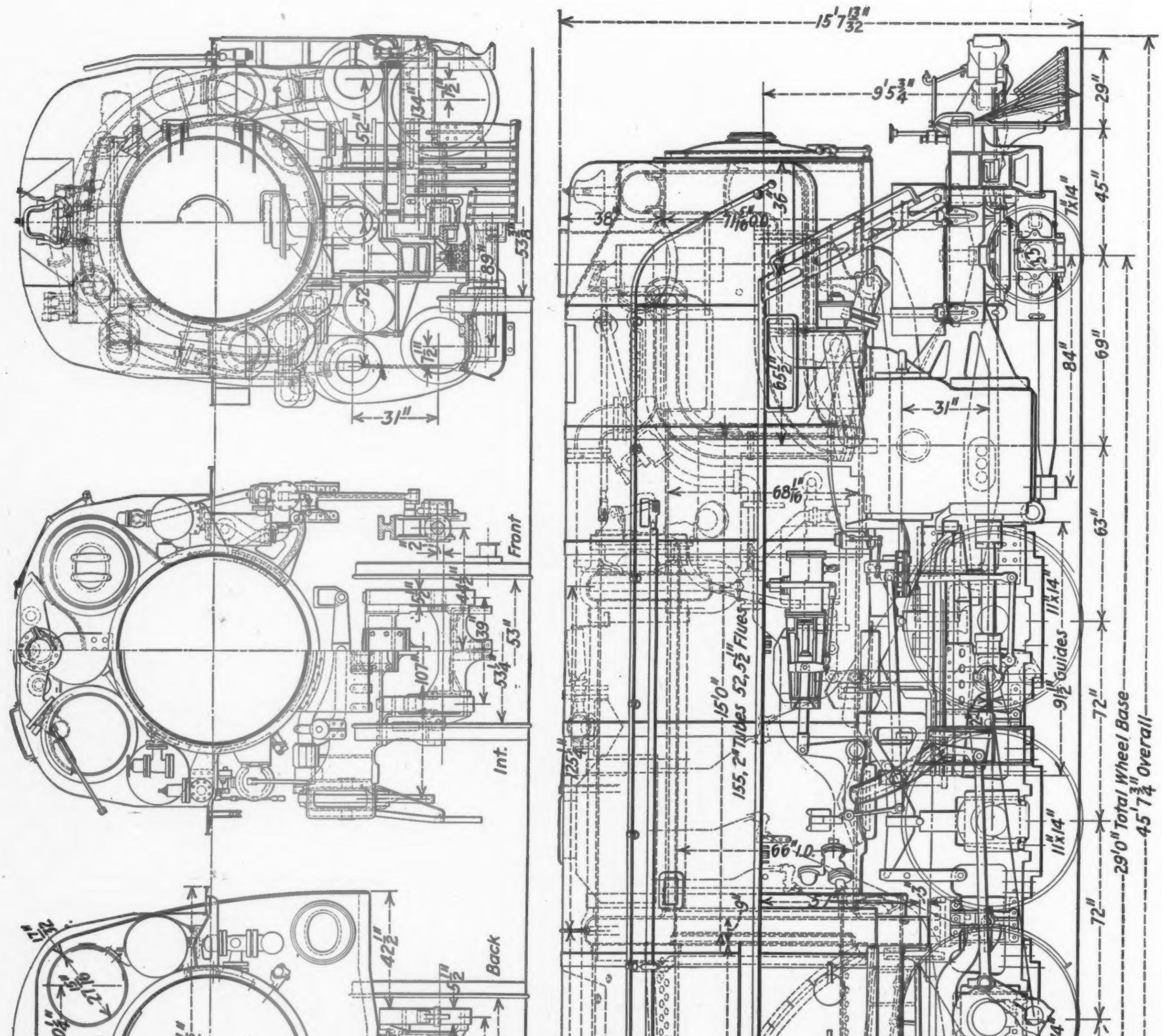
Equipped with water-tube firebox similar to "John B. Jervis"—Working boiler pressure of 500 lb.

THE American Locomotive Company recently delivered the third of the high-pressure series of locomotives which are being developed by the Delaware & Hudson. This locomotive, which is named the "James Archbald," is similar in many respects to its predecessors the "Horatio Allen" and the "John B. Jervis," The "Horatio Allen," it will be remembered, was placed in service in December, 1924, with suitable christening ceremonies. A description of this locomotive, which operates at a working pressure of 350 lb., appeared in the February, 1925, issue of the *Railway Mechanical Engineer*, page 79. The second locomotive of the series was named the "John B. Jervis" and operates at a pressure of 400 lb. A description of the "John B. Jervis" appeared in the April, 1927, issue, page 207.

Like its predecessors, the "James Archbald" was named after an engineer who played an important part in the early history of the Delaware & Hudson. The new locomotive operates at a boiler pressure of 500 lb. and has a cross-compound cylinder arrangement. It exerts a maximum tractive force of 84,300 lb., operating single-expansion, and 70,300 lb. when working compound. The tender is equipped with a Bethlehem auxiliary locomotive which exerts a tractive force of 18,000 lb. The driving wheels have a diameter of 63 in. The high-pressure cylinder has a diameter of 20½ in. and the low-pressure 35½ in. The stroke is 32 in. The total weight of the engine is 356,000 lb. of which 300,000 lb. is carried on the drivers and 56,000 lb. on the engine truck.

The Boiler of the "James Archbald"

The fire-tube boiler is of the straight-top design and is constructed with two courses. The shell plates and welt straps are of silica-manganese steel, and the other



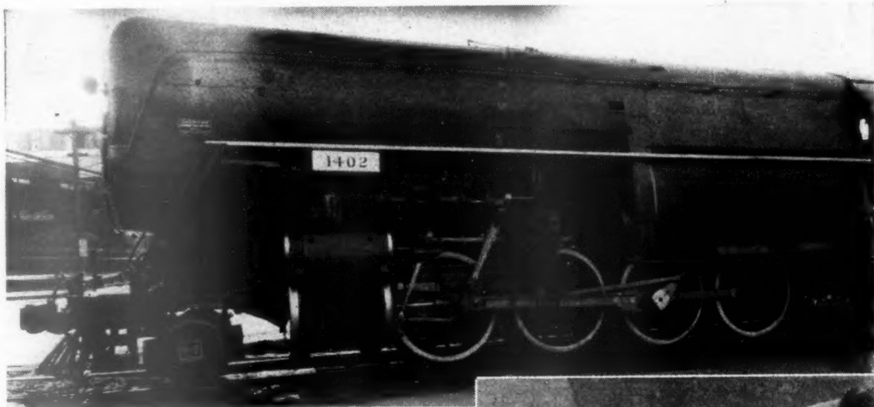
Elevation and cross-sections of the Delaware & Hudson 2-8-0 type high-pressure locomotive "James Archbald"

plates used in the construction of the boiler are low-carbon nickel steel. The front sections of the steam drum have an outside diameter of 29 in., and a length of 12 ft. 7 in. The rear sections of the steam drums have an inside diameter of 29 in. and a length of 12 ft. 7¼ in. The drums are fitted with cupped-in heads. The front heads are provided with corrugated forged-steel manholes. The back heads of the drums are solid.

A 9-in. water-leg type of rear header is employed to connect the rear ends of the upper steam and the lower water drums. The water drums have an inside diameter of 20¼ in. and are 12 ft. 7$\frac{5}{16}$ in. long. The header is closed at the bottom with a steel foundation casting 4 in. deep. Lugs are provided on this casting to which the waist sheets are bolted.

The combination header at the front end of the firebox is flanged and riveted to connect the fire-tube barrel with the central portion of the upper steam and front ends of the lower water drums. As in the rear header, a uniform 9-in. water space is provided. The lower end of this header is also fitted with a steel foundation casting having lugs for attachment to the boiler bearings on the engine frame.

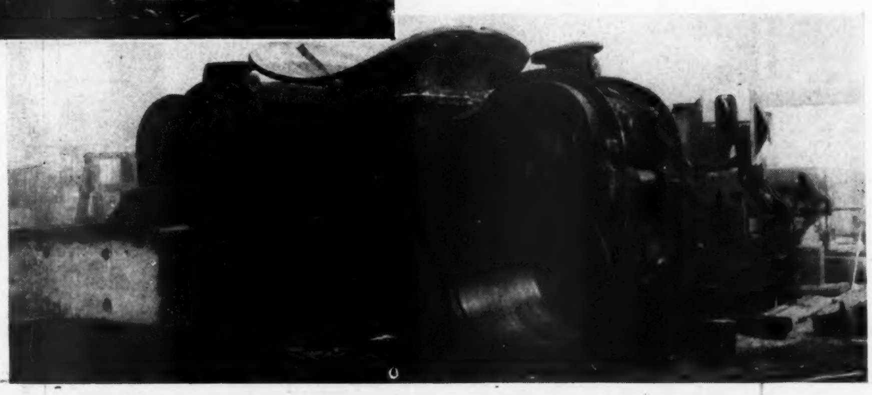
The front combination header and dome is of the



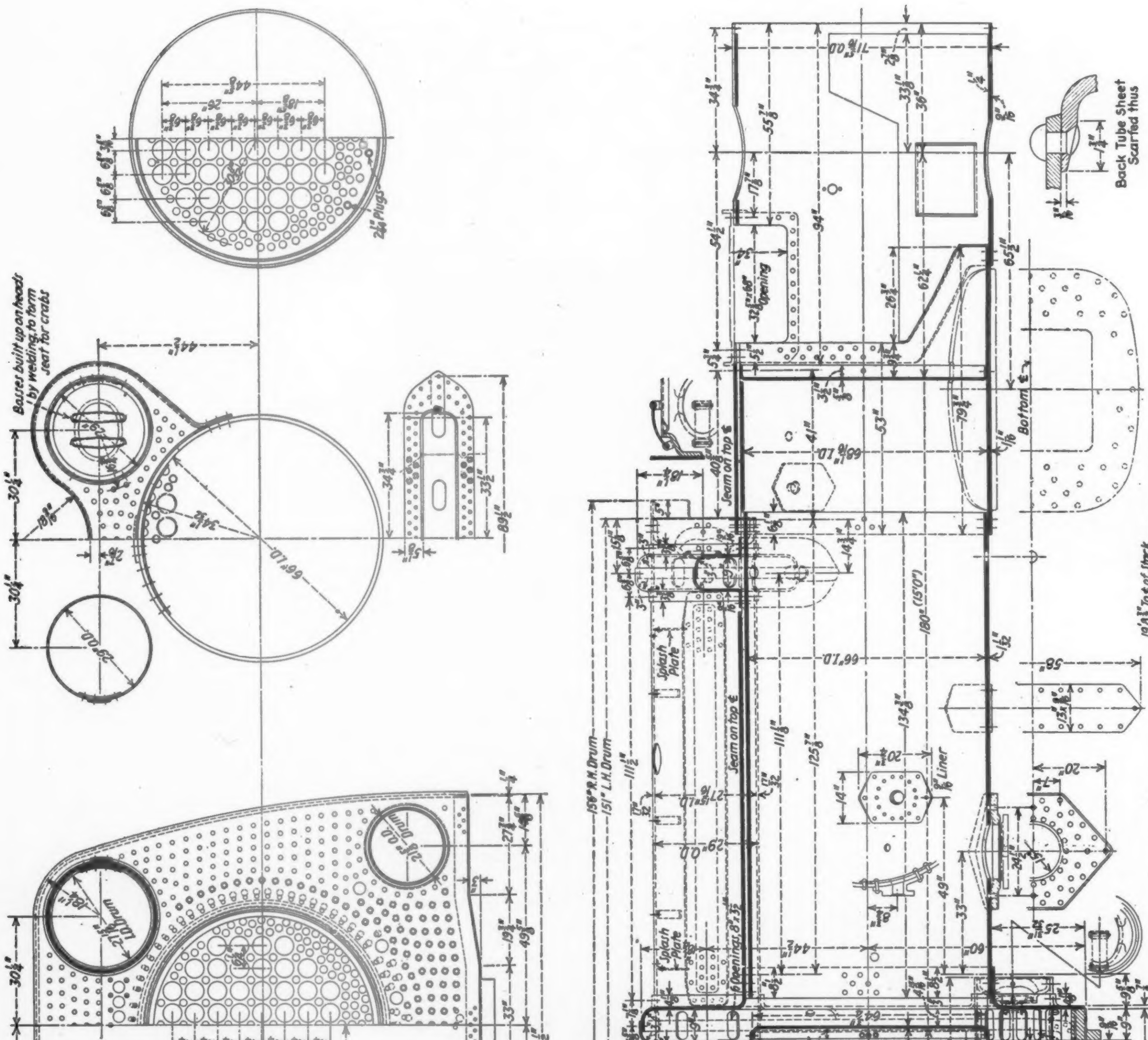
View showing the left side of the locomotive

The boiler and firebox as it appeared when completed

The frames previous to applying the cylinder castings



The frame assembly—The low-pressure cylinder is shown at the right



Longitudinal and cross-sections through the boiler of the "James Archbald"

same type of construction as the center and rear headers, and is used to connect the firetube barrel with the front ends of the steam drums. A uniform water space of 9 in. is maintained between sheets. Special attention was paid to the design of the header and to the water and steam-drum connections to provide for an adequate circulation of water and sufficient steam outlet, at the same time giving amply strong construction.

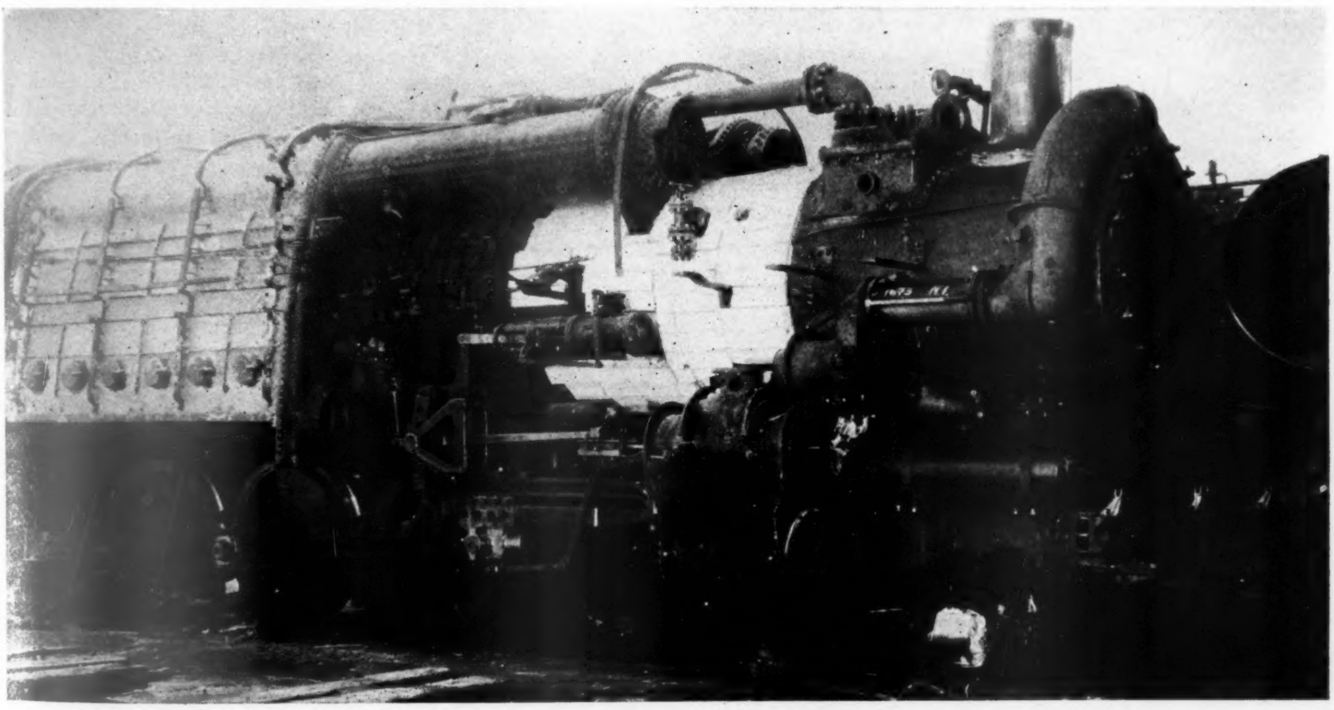
The watertube firebox is 152 in. long and 77⅝ in. wide inside of the sheets. A 36-in. by 12½-in. fire-door opening with riveted seams which are sealed by welding is located in the rear header. Considerable care was exercised in applying the tubes to insure tight connections. The staggered arrangement of water tubes is the result of experience with previous installations. Adequate firing clearance and combustion volume at the front of the firebox have been provided by giving ample distance from the grate surface to the under side of the baffle wall.

Plates are fitted over the water tubes which are retained in position by a skeleton framework between the steam and water drums. This covering makes air- and smoke-tight joints with the center and rear headers, and the top and bottom drums under all conditions. Dusting doors are located in the fireproof metal covering insulation and jacketing on each side of the firebox so that ash, which may accumulate on top of the water drums and in each of the right and left banks of water tubes, can be blown off from the outside of the boiler.

The ash pan, fitted with two sliding covers, is well braced to prevent warping and burning, and is substantially supported at the water drums, rear header and bridge-wall support, and from the expansion plates and engine frames. It is made with approved lap joints and is dust proof, except at the side air openings im-

Principal Dimensions, Weights and Proportions of the D. & H. High-Pressure Locomotive "James Archbald"

Railroad	Delaware & Hudson	
Builder	American Locomotive Company	
Type	2-8-0	
Service	Freight	
Cylinders, diameter and stroke	H. P.—20½ in. by 32 in.	
	L. P.—35½ in. by 32 in.	
Valve gear, type	Walschaert	
Valves, piston type, size	H. P.—12 in.;	L. P.—14 in.
Maximum travel	9 in.	8½ in.
Outside lap	1⅜ in.	1½ in.
Exhaust clearance	⅛ in.	¼ in.
Lead in full gear	1/16 in.	¼ in.
Weights in working order:		
On drivers	300,000 lb.	
On front truck	56,000 lb.	
Total engine	356,000 lb.	
Tender	277,500 lb.	
Total engine and tender	633,500 lb.	
Wheel bases:		
Driving	18 ft.	
Engine	29 ft.	
Total engine and tender	80 ft. ½ in.	
Wheels, diameter outside tires:		
Driving	63 in.	
Front truck	33 in.	
Journals, diameter and length:		
Driving, main	12 in. by 14 in.	
Driving, others	11 in. by 14 in.	
Front truck	7 in. by 14 in.	
Boiler:		
Steam pressure	500 lb.	
Fuel, kind	Soft coal	
Diameter, first ring, inside	68 1/16 in.	
Firebox, length and width	151 15/16 in. by 77⅝ in.	
Tubes, number and diameter	155—2 in.	
Flues, number and diameter	52—5½ in.	
Length over tube sheets	15 ft.	
Grate area	81.9 sq. ft.	
Heating surfaces:		
Firebox	1,048 sq. ft.	
Arch tubes	66 sq. ft.	
Tubes and flues	2,325 sq. ft.	
Total evaporative	3,439 sq. ft.	
Superheating	1,037 sq. ft.	
Combined evap. and superheating	4,476 sq. ft.	
Tender:		
Water capacity	14,000 gal.	
Fuel capacity	17½ tons	
General data, estimated:		
Rated maximum tractive force, simple	84,300 lb.	
Rated maximum tractive force, compound	70,300 lb.	
Tractive force, auxiliary locomotive	18,000 lb.	
Tractive force at starting	102,300 lb.	
Weight proportions:		
Weight on drivers ÷ total weight engine, per cent	84.4	
Weight on drivers ÷ tractive force, simple	3.56	
Weight on drivers ÷ tractive force, compound	4.28	
Boiler proportions:		
Tractive force, simple, ÷ comb. heat. surface	18.83	
Tractive force, compound, ÷ comb. heat. surface	15.7	
Tractive force, simple, × diam. drivers ÷ comb. heat. surface	1,185	
Tractive force, compound, × diam. drivers ÷ comb. heat. surface	988	
Firebox heating surface ÷ grate area	1.36	
Firebox heat. surface, per cent of evap. heat. surface	32.5	
Superheat. surface, per cent of evap. heat. surface	30.2	



The "James Archbald" in the shops of the builders at Schenectady, during the process of construction

mediately below the water drums. An air opening of 100 per cent is provided by the netting in the sides of the pan. A plate over the air openings is so arranged as to prevent fire from dropping. The ash-pan dampers are automatically operated. An ash-pan flushing or washout arrangement, which is operated by steam through a ¼-in. perforated pipe, is located at the top slope of the ash-pan sides.

All of the fire tubes and flues are of hot-finished seamless nickel steel. They are set according to the railroad standard practice with beads at the back tube sheet sealed by fusion welding and with the beads rolled at the front tube sheet, not welded. To insure that the steel tubes would be sufficiently strong for the pressure under which the boiler will operate, the specifications called for 5½-in. flues having an elastic limit of 40,000 lb. per sq. in. and a tensile strength of 60,000 lb. per sq. in., which were required to meet a hydrostatic test of 1,500 lb. per sq. in. The 2-in. tubes also have a strength of 60,000 lb. per sq. in.

List of Special Parts, Appliances and Equipment Applied on the D. & H. High-Pressure Locomotive, the "James Archbald"

Owner	Delaware & Hudson
Builder	American Locomotive Company
Number built	One
Boiler details:	
Blow-off muffler	Okadee
Blower valve	Coale, quadrant-type intermediate
Blower valve fittings	Barco
Drifting valve	Ardco
Drums	Low carbon nickel steel
Exhaust nozzle	Coddington type
Feedwater heater	Dabeg
Feedwater heater check	Hancock
Firebrick arch tubes	Pittsburgh Steel Products
Firedoor flange	O'Connor
Grate bars	Q & C Company (Nogroth)
Injector and injector check	Hancock
Lagging—Dry pipe and boiler shell	Asbestos sponge felt
Lagging—Firebox sides and between drums	Super-ex
Low water alarm	Barco (Cleveland)
Pyrometers	Brown Instrument Company
Reducing valves	Leslie
Safety valves	Okadee
Superheater pipes	Pittsburgh Steel Products
Water gage and fittings	Nathan
Cylinders and running gear:	
Bushings, cylinder and valve	Hunt-Spiller
Crosshead pin	Alco (Becker)
Cylinder cock	Okadee
Driving and engine truck tires	Railway Steel Spring
Driving box cellar, main	Edmonds
Driving box cellar, others	Elvin type
Frames, front, and cylinder castings	Ohio Steel Foundry
Frames, main engine	American Steel Foundries (Hylastic)
Guides, slide	Alco
Packing, high-pressure piston rod	U. S. Metallic (King tandem)
Packing, low-pressure piston rod and valve stem	U. S. Metallic (King simple)
Retaining rings, tires	Mansell type
Reverse gear	Alco (type G)
Rings, piston valve bull and packing	Hunt-Spiller
Sanders	Graham-White
Valves, piston type	Economy straightway port
Cab:	
Back-pressure gage	Duplex
Speed recorder	Valve Pilot Corp.
Throttle	Bradford (Wagner)
Miscellaneous:	
Bearings	Magnus
Bell ringer	Transportation Devices
Brakes	New York
Brake beams	Bradford
Bumper, front engine	Commonwealth
Drawbar	Franklin (Unit safety)
Flexible joints	Barco
Headlight	Pyle-National
Lubricator, hydrostatic	Detroit
Lubricator, mechanical	Madison-Kipp
Radial buffer	Franklin
Tender:	
Auxiliary locomotive	Bethlehem
Coal pusher	Standard Stoker (Type DA)
Drawgear	Miner
Frame	Commonwealth
Front truck	Am. Steel Foundries (Economy)
Wheels, front truck	Am. Steel Foundries (Davis steel)

The smokebox is of the extended type and has a front of cast steel. The front end is arranged for a 22-in. stack and basket type netting. The locomotive is provided with an independent annular exhaust of ample size with suitable connections for operation of the cylinders in simple gear. An independent annular conduit with four outlets for the blower is also provided. Extra heavy pipe has been installed between the smokebox shelf and the exhaust-pipe connections for the stack blower which is flexibly arranged to avoid the possibility of leakage or breakage. The exhaust-nozzle, smoke-stack and front-end design and arrangement is such as to give, when operating in compound gear, the greatest draft per pound of cylinder back pressure.

The Wagner throttle valve is designed for operation at a working pressure of 500 lb., the temperature of the superheated steam to average about 700 deg. F. and not to exceed 750 deg. F.

The cross compounding system has the Mellin automatic intercepting and feed valves and is designed for 500 lb. steam pressure and 300 deg. F. superheat. Steam distribution is controlled by a Walschaert gear. The intercepting valves are located outside of the cylinder and take steam from a steam pipe connection on the cylinder. The large end of the reducing valve is designed to have eight bridges and two packing rings.

The locomotive is designed to start in simple gear, but provision has been made for changing from compound to simple gear when necessary to prevent stalling. Under ordinary conditions, the engine operates in simple gear up to a speed of from six to seven miles an hour. A control valve is provided which permits the engineman to change from simple to compound and vice versa whenever desired. The cross compounding system is designed to coordinate fully with the valve motion under all conditions and requirements of operation, and in all forward and back-up cutoffs where practical.

The cylinders and frames are essentially of the same construction in the "James Archbald" as in the two former locomotives. The main frames terminate just back of the cylinders where they are bolted to a combined steel saddle casting and front deck plate. The high-pressure cylinder is bolted on the left side of this casting and the low pressure cylinder on the right side. As in the "John B. Jervis," the smokebox saddle fit is a separate casting which is bolted to the top of the main saddle casting, thus permitting the removal of the boiler without disturbing the smokebox saddle fit or the main-frame splice.

The "James Archbald" is 19,500 lb. heavier than the "John B. Jervis" and 8,000 lb. heavier than the "Horatio Allen," which have total engine weights of 336,500 lb. and 348,000 lb. respectively. Both the "James Archbald" and the "Horatio Allen" have a rated maximum tractive force, simple, of 84,300 lb. and, compound, of 70,300 lb. The "John B. Jervis" has a rated tractive force, simple, of 85,000 lb. and, when operating compound, of 70,800 lb. The auxiliary locomotives which replace the rear tender trucks, exert a tractive force of 18,000 lb. on both the "James Archbald" and the "John B. Jervis."

No outstanding changes have been made in the running gear of the "James Archbald," although there are a number of refinements in some of the details. The main and side rods, crank pins and driving and engine-truck axles, are of nickel steel. The cylinders are made of cast steel and are of Economy-Franklin straightway port design.

The tender has a water capacity of 14,000 gal. and 17½ tons of fuel. It is carried on 10 wheels. The front truck is of four-wheel design. The rear end of the tender is carried on a six-wheel Bethlehem auxiliary locomotive of the same design as that used on the "John B. Jervis."

Corrosion of Steel Freight Cars

Some practical suggestions are advanced regarding effective corrosion-prevention methods

By P. P. Barthelemy

Assistant Master Car Builder, Great Northern, St. Paul, Minn.

Corrosion largely responsible for this skeleton of what once was a steel gondola

THE corrosion of steel cars depends upon a number of conditions, among which are the following: General design of the car; detail design of parts; physical and chemical properties of the steel; care of the steel prior to using; preparation of the material for assembly; rust-preventative measures in assembly; character of the commodity for which the car is designed; maintenance attention; climatic and operating conditions (important when the cars are localized). Intelligently applied corrosive prevention measures are of primary importance, but, in order to determine just what these should be, a thorough analysis of the cause and effect of rust action on each part of the car is essential.

SOME steels, including alloy steels, used in car construction are better rust resistants than others. Promising developments with strong aluminum alloys are under way. The extra cost involved in the use of alloys must not be out of proportion to the benefits derived, but relatively expensive corrosion-resisting alloys may well be justified for car parts which are costly to renew on account of involved structural conditions. These points, together with many suggestions for minimizing destructive corrosion of steel car parts, are advanced in this informative article.

Some steels rust more rapidly than others under like conditions. Some alloy steels are better rust resistants than others. In the use of alloy steel, it must be borne in mind that the corrosive action is not just plain oxidization, as, when handling certain commodities such as coal and ores, there is frequently a chemical reaction due to the commodity or the impurities contained therein when exposed to the atmosphere, more particularly in the presence of moisture. Chemical action may be set up between the lading and the steel, or between iron-attacking chemicals released. Therefore, it is of importance to know that the alloy used not only protects the steel from ordinary oxidization, but will also protect it from excessive corrosive action due to the chemical peculiarities of the particular commodity for which the car is intended.

Costs involved in the use of alloys must not be out of proportion to the benefit to be derived. Certain parts are subject to much heavier corrosion than others; some parts are very expensive to renew due to involved structural conditions. The use of comparatively expensive alloys that will appreciably retard corrosion is justified for such parts. With ordinary care, other parts made of ordinary steel will last the life of the car insofar as rusting away is concerned; therefore, the use of an alloy that would materially increase the cost of the car would not be justified for such parts simply as a rust preventative.

All car men are watching with interest the progress being made in the aluminum industry, particularly in the development of alloys of this metal that shall possess the requisite properties to make them adaptable for use in railway car construction, not the least of which is reasonableness in cost. Such alloys have great possibilities and once the demand becomes urgent enough we may expect more important developments in that part

of the industry. In developing the use of this material, however, careful consideration must be given the chemical peculiarities of aluminum and its alloys with relation to chemical properties of ladings which may normally come in contact with them.

Corrosion may be divided into two general classes: that which takes place on the exposed surfaces of the steel and that which takes place at joints and between laps of the structural parts.

In the case of open cars, and, to a degree, other cars, surface action may be divided as between exterior face, not coming in contact with lading nor exposed to drippings, and interior face, in contact with lading or exposed to drippings. It is obvious that the action is much more severe on interior than on exterior surfaces. A properly-applied protective paint that will last several years can be applied to exterior surfaces. The adequate protection of the interior, however, presents obstacles difficult to surmount. A coating may be applied, but the abrasive and chemical action of the lading wears it off, then flakes of rust are formed. Rust, being porous, holds moisture, which further assists in the rusting process and thickening of rust scale. When the scale is rubbed off, perceptible pits are left in the surface. Repeated action of this nature causes the pits to increase in size and depth, until the plates are weakened and eaten away at vital places to the point of destruction.

Rusting will take place under favorable conditions on exterior surfaces. Loose or porous scale that will hold moisture, paint film loosened from surface due to lack of proper preparation of surface, or to other causes, forms pockets that hold moisture. A protective coating that, owing either to inferior or improper material, does not provide a lasting film, may develop fine checks through which water soaks; paint eaten away by acid action contributes to exterior corrosions, as does also abrasion due to pounding to loosen load, etc.

Suitable Protection of Stored Steel Plates Essential

While the rust action on outside sheets is of far less severity than on the inside, it is nevertheless important that sheets be properly protected. Plates in storage should be kept in a dry place to prevent rusting and pitting. They should be properly sandblasted to remove mill scale, such rust as may have occurred and oil stains. The car is then to be painted in the approved manner. Good paint materials should be used. Since inferior paints require as much labor to apply, the saving in material cost must be considerable to justify their use.

The corrosive action in the joints and laps is by far the most serious. The unfilled spaces between parts draw and hold water and such chemicals as may be released from the lading. They also fill with fine particles of the lading, forming an absorbing and retaining sponge which prolongs and intensifies the destructive corrosion action.

Obviously proper measures should be taken to minimize this action. In the first place, surfaces to be lapped should be freed from all scale, then treated with a first-class protective material. When making laps and joints, if a hard-drying surface paint is used, it should be followed by a heavy filling coating which will remain tough and elastic after setting, will not be affected by moisture and ordinary acids, and will undergo a minimum of damage due to hot rivet application.

Car cements are being quite extensively used instead of ordinary paint, not only for coatings for surfaces, but as a protective coating and filler for laps and joints preparatory to riveting. These materials, as coatings, appear to adhere more thoroughly to the surface than ordinary paints, remain elastic much longer, and form a much better seal at joints and seams. As a coating for assembly surfaces, they not only adhere to the surfaces, but fill much more thoroughly the cavities between sheets, thus excluding moisture and effectively retarding rust action.

In the case of the composite car, the contact surfaces of steel members to the wood should, prior to assembly, be given a heavy coating of car cement or paint, as these contact surfaces are subject to severe rusting.

After riveting, the edges of lap should be again coated

Unchecked corrosion may be charged as the primary cause of this activity in the reclamation yard

with the filler, either by blowing or brushing, to fill all remaining cavities and thoroughly seal the seam against the entrance of moisture.

Since inside drippings, owing to the presence of chemicals, react more rapidly on the steel and parts remain wet longer from contact with lading than the exterior, it follows that laps of plates and other parts on the interior or exposed to dripping from the interior, should shed downward in the interior instead of the exterior, as is the common practice.

In the design of the car, joints and laps should be avoided where feasible. Rolled sections or castings may be used instead of built-up parts, particularly for underframe construction and for some of the detail parts. Castings may be used instead of built-up parts or pressings for many of the details, thus not only eliminating joints but providing a better rust-resisting material.

One-piece hopper doors designed to shed water will

Unprotected steel plates exposed to corrosion before application to cars

wear much longer than those built up from the same kind of material. The one-piece, cast-steel hopper door has many advantages in that this material is a better rust resistant than rolled steel, and that ribbing and other desirable localized strengthening may be provided in the design without adding objectionable excess weight. The plates of these should not be of excessive thickness, as minor imperfections that may occur in the casting of thin plates may be corrected by means of the welding torch. This procedure is preferable to making the plate of greater thickness to insure a perfect casting, if such thickness is not otherwise necessary. The same weight of steel, properly distributed to ribbing and bracing, has a far greater carrying value than when used in the face plate itself.

Weakly Constructed Cars Demoralize Service

It is fair to assume that train weights will continue to increase in the future about as they have in the past; therefore, a sufficiently high strength factor must be used to meet these expected conditions. This may lead to what appears to be a present excessive tare weight. On the other hand, there are few more demoralizing agencies to first-class service than weakly constructed cars. Car strength is a timely subject, since there appears to be an overzealousness in some quarters to force tare weight down to what may in a few years be found to be then below the safe and economical operating limit. We should take warning from past experience, as, for example, the trouble had with some of the early designs of steel cars, which were woefully weak and caused much trouble on that account.

Because of the continued increase in the size of locomotives, there is a corresponding increase in the weight of trains, and resultant car stresses. The relationship of the locomotive to the car may be likened to a detachable hook used on a series of chains. It is a comparatively easy matter to make a new and heavier hook. It is an entirely different matter to go through and strengthen the hundreds of thousands of different chain links which may go to make up the particular chains on which the larger hook may be used. Adding strength to an existing car, with some exceptions, is impracticable, and what can be done is so expensive that the more practical method is to make proper allowance for reasonable future expectations, based, of course, on life expectancy for the car, as well as other operating conditions. The underframe should be structurally protected from drippings by providing overhanging edges, where possible, and by a thorough coating of suitable protective material. Where possible, laps should be made with exposed edges turned downward to shed water, instead of upward where they catch moisture and permit it to soak into the joints.

In the construction of certain types of cars and in certain locations, a layer of heavy waterproofed felt paper, laid over a generous coating of car cement, will serve to protect top surfaces. Where it may be done, the felt paper should project beyond the edges of the steel so that the drippings, if any, will be shed clear of the steel members.

Where composite construction is used, the contact surface between the wood and steel should be coated with a good waterproofing material, one that will adhere thoroughly. Horizontal surfaces, such as those between nailing stringers and steel sills, should be protected in like manner, and, if of considerable width, such as cover plates, adequate ventilation will help materially in keeping such surfaces dry, thereby reducing rust action.

A thorough study should be made to ascertain the advisability of protective treatment. Floor boards on the steel flat and open car should be treated. While these break before wearing out, the breakage is mostly due to wood deterioration which has destroyed the strength of the piece. The decay action on other parts may be negligible, and treatment of such parts would not be warranted.

Underframe nailing stringers, when used, should be thoroughly creosoted, if feasible, as such a treatment not only serves to prolong their life but also renders them practically waterproof, in which case there will be a very much reduced rust action where these parts come in contact with the steel. Since these stringers are usually quite expensive to renew, it is important that all reasonable measures be resorted to which will prolong their serviceability.

Vulnerable Spots in the All-Steel Box Car

The all-steel box car presents peculiar conditions, many of which require a more careful study to be adequately met. The most vulnerable locations for rust action are the bottom portions of steel side and end sheets, and the side and sill structurals. The corrosive action is practically all from the interior. The contact areas between the steel parts and flooring and floor nailing strips hold moisture in contact with the steel, and, since ventilation of these parts is very limited, as is also moisture evaporation, such parts frequently remain in a moist condition for a long period of time. This moisture gets into such localities in various ways,

the most common being rain and snow through open side doors, moist or wet commodities, "sweat" condensation on interiors due to temperature differences between the interior and exterior, such as warm loads in cold weather, washing out cars, etc.

There is also an appreciable amount of vibration near the bottom of side and end sheets, due to the weave of the car, handling shocks, etc. This tends to hurry corrosion by destroying the protective film coating ordinarily used, thus exposing the steel surface. These plates are so thin, comparatively speaking, that their serviceability is short-lived under ordinary or adverse conditions.

Among the remedies for these conditions are the use of heavier plates at the bottom portion of side and end sheets. The added thickness would prolong the life against corrosion, and would also largely prevent the sharply localized vibrations obtaining where sheets are of light uniform thickness. The protective coating, applied to interior surfaces near the bottom, should form a durable and flexible protective covering. The giving of nailing stringers a thorough creosote treatment and waterproofing coating will not only greatly lengthen the life of such parts against decay, but will prevent them absorbing water and slowly feeding it to the steel contact surfaces. A good waterproof filler, applied to seal the cracks and other cavities between the decking ends and side sheets, is another protective measure worth considering.

The surfaces of the steel must, of course, be thoroughly prepared by the removal of all scale, oil, etc., before being coated with the protective covering, and a filler should be thoroughly applied to seal all openings at joints and seams. Waterproofing felts may also be advantageously used in locations where such protection is necessary, these preferably laid in a wet coating of suitable waterproofing material.

Specially rolled shapes for side-sill members may be used to good advantage. These should be designed to provide a vertical member for side-sheet riveting which will raise that seam above the top of the floor boards of the cars.

Composite open-car construction in many instances tends to reduce vital corrosion, particularly under the more adverse conditions previously mentioned. This construction is, however, far from a cure-all, and should be given preference over all-steel only where actually warranted and after a careful study of service conditions for which the car is intended. In cars of like actual strength the composite car weighs much more, because there is not the intimate rigid connection or unison of action between various parts which obtains with all-steel construction.

Cast-steel underframes deserve careful consideration in connection with the war on corrosion. This construction is particularly adaptable to the design of the heavy capacity ore and coal hopper cars. This material is a good rust resistant, and, added to its slow corrosiveness, it has the advantage that there are no joints or laps, that all details such as bolsters, draft stop, striking plate, lugs and projections for attaching body parts and hopper doors, etc., are cast integrally with the frame; also fillets, ribs, etc., may be provided where needed; members may be proportioned throughout their length to meet load conditions without adding unnecessary weight, as is frequently the case with rolled sections where they must be of sufficient weight throughout to meet what may be a localized load over only a small part of their length.

Welding an Important Ally in Rust Prevention Work

Welded joints and seams, particularly at points which are exposed to strong corrosive action, will, if intelligently used, help prolong the life of such parts, as by this process the seams are sealed against corrosive substances.

The adoption of the welding process will also make it possible in a great measure to simplify constructions, eliminate objectionable shelves or shoulders, and, in a measure, contribute to the lightening of the car weight.

That in the near future welding will displace riveting to a very large extent in car constructions there can be no doubt, and extensive experiments with this process are highly desirable. As soon as a broadened field in this direction is reasonably assured, the development

These sheets are too far gone to save by painting

of suitable welding devices for doing speedy and accurate work will be encouraged.

Climatic conditions have an important bearing on rust action. It is easily understandable that exposed steel surfaces will rust very rapidly in a warm, humid atmosphere. This destructive action is intensified on open cars loaded, for instance, with wet coal which releases steel-attacking acids, particularly so if the cars are held under load for some time. Under such conditions, bodies of steel cars have been found to be totally rust destroyed in ten to twelve years.

On the other hand, similar cars in localized service in the dry, cold climates, and under favorable lading conditions, are still serviceable so far as rust destruction is concerned after being in use more than 25 years. Comparatively dry winds evaporate moisture from the car parts, thus minimizing corrosive action. Furthermore, rust action comes practically to a standstill in subfreezing weather. Extreme cold, however, contributes indirectly to rust destruction in that cars are then harder to handle, and usually receive much rougher treatment in both switching and train service. Steel parts are more easily damaged, and, as a result of these conditions, the car structure is more or less loosened, exposing additional areas to future rust action.

On old open steel cars, after being in service several years, an encouraging degree of success has been attained in the retardation of rusting by the application of special coatings. In this process the heavy scaling

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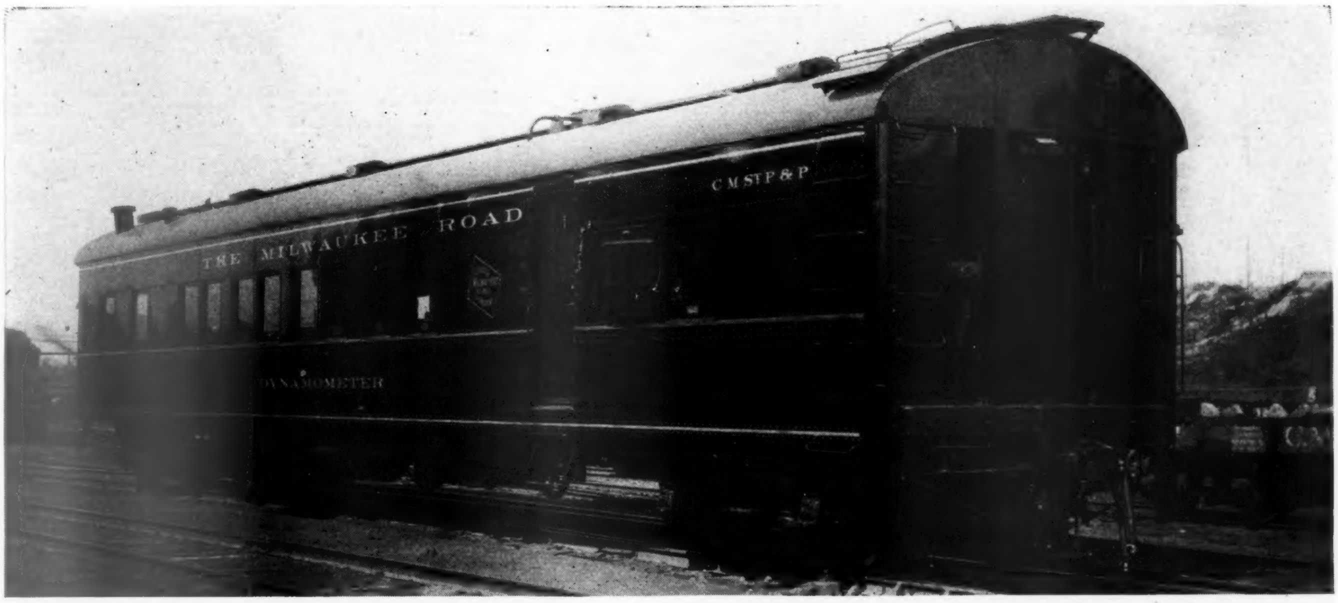


Dynamometer car recently completed at the Milwaukee shops of the C., M., St. P. & P.

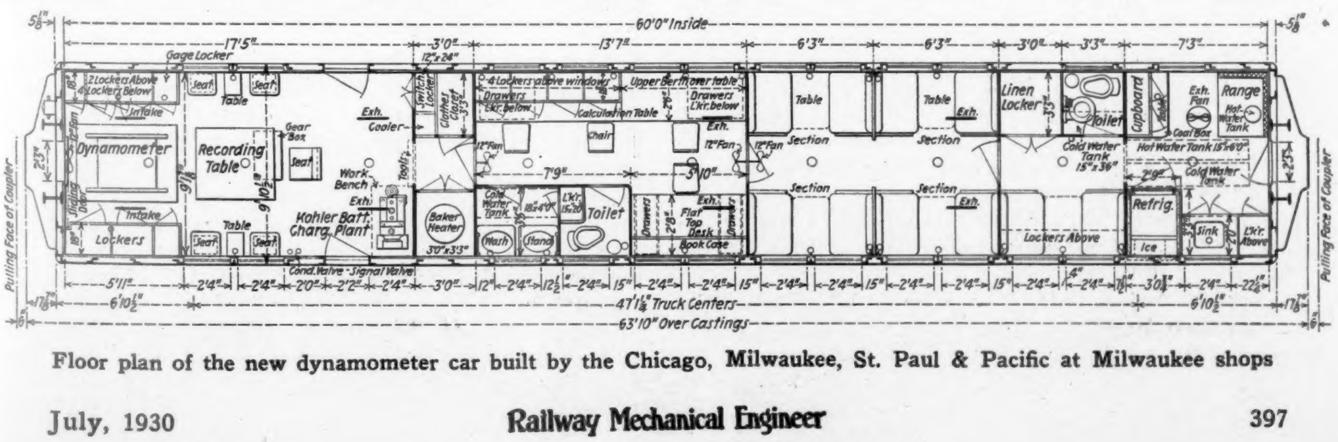
New Milwaukee Dynamometer Car

Large living quarters and complete modern equipment for test car operation provided

THE Chicago, Milwaukee, St. Paul & Pacific recently placed in service an all-steel dynamometer car, built at its Milwaukee (Wis.) shops and designed to register a drawbar pull up to 250,000 lb. and withstand a buffing shock of 1,250,000 lb. This road has operated a dynamometer car for many years and, with this experience as a background, it is believed that all undesirable features inherent in the previous car have been eliminated. Living accommodations in the new car have been made as complete and large as possible and ample locker room provided. The car is constructed throughout to withstand the severe service to which it will be subjected.

The car measures 60 ft. by 9 ft. 1-7/8 in. on the inside and weighs 132,000 lb., fully equipped. The car has a built-up steel underframe with center sill composed of two 15-in., 45-lb. channels, 44 ft. 11 in. long, a 28-in. by 1/2-in. by 43-ft. 10-3/4-in. cover plate, and two 5-in. by 5-in. by 1/2-in. bottom cord angles, 39 ft. 11 in. long. The side sills consist of 6-in. by 4-in. by 1/2-in. angles. The structure is rigidly tied together by crossbearers and numerous crossties closely spaced. To obtain additional strength, the dynamometer end is fitted with a 1/2-in. steel reinforcing plate, 11 ft. 2 in. long by 9 ft. 9-1/2 in., which is securely riveted to the side sills, center sill, and platform casting. The four end posts are 12-in., 31.8-lb. I-beams and those on the dynamometer end extend through the platform casting approximately 12 in., thereby giving a solid foundation for jack supports while the weighing head is being calibrated.

Four-wheel Commonwealth cast-steel trucks with 33-in. solid steel wheels are used, and all wheels are equipped with clasp brakes, except the rear wheels of

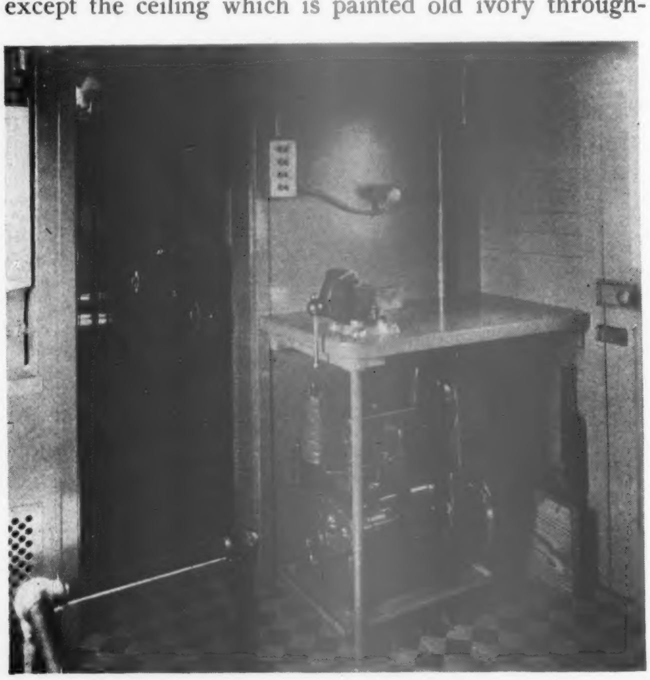


Floor plan of the new dynamometer car built by the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee shops

the front truck, the axle of these wheels being used in connection with the paper drive mechanism.

The car body is of steel and thoroughly insulated. The interior lining is composed of 13/16-in. tongue and groove sheathing and the floor of 13/16-in. tongue and groove oak. The floor is covered with black and gray checkered linoleum, except for the heater room. Three-ply hair felt is used as insulating material on the sides and ceiling, and 2-in. compressed cork below the double floor.

Since the car is used in freight service for the greater part and always coupled next to the locomotive, it was painted black with two 1½-in. aluminum borders, rather than the standard yellow color that is employed for the Milwaukee passenger trains. The external color scheme is similar to the tenders of this road's new passenger locomotives. On the interior, the sides of the dynamometer room and kitchen are battleship gray except the ceiling which is painted old ivory throughout the car. The sleeping quarters, office and porter's section are finished in mahogany stain. The interiors of the wash rooms, lavatory, toilets and all lockers were finished in old ivory.



Work bench with Kohler battery-charging unit underneath

Comfortable Crew Quarters Provided

The space provided for the living quarters of the crew occupies 42 ft. 7 in. and consists of the kitchen, porter's quarters, four berth sections, office, toilets and lavatories. A kitchen 7 ft. 3 in. long is located at the rear of the car and is fully equipped and well lighted. It is fitted with a car coal range. A large refrigerator, iced from the roof, is located in one corner. Other features include a sink covered with Monel metal, metal dust-proof coal box, a work shelf covered with Monel metal, ample lockers and motor-driven exhaust fan. Suspended from the ceiling are two copper gravity water tanks with a capacity of 110 gal., and a connection to the hot water coil and copper supply tank of the range.

A porter's room, 6 ft. 6 in. long, is adjacent to the kitchen and consists of a lower berth with lockers above. Opposite this berth are a large linen locker and toilet with folding washstand and mirror above. In the passageway between the porter's room and the sleeping quarters of the crew is a hinged door that assists in keeping out the kitchen odors from the remainder of the car. A door at the forward end of this room also assures greater privacy. The crew's sleeping quarters consists of four Pullman sections, thereby providing space for eight men. The seats are completely covered with brown imitation leather, which facilitates their cleaning. Individual berth lights, table lights and ceiling lights provide the proper illumination, while ventilation is accomplished by a 12-in. electric fan, sash ventilators and two Utility exhaust ventilators. By the use of removable tables, this space is also utilized as a dining room.

Next to the crew's sleeping quarters is the office which occupies a space 13 ft. 7 in. long. In this space is also provided a toilet and a lavatory. The lavatory contains two Monel metal washstands, two mirrors, wall lights overhead, hot-water tank and large full-length locker, providing ample storage space for toilet articles and supplies. On the right side of the room is a computing table, 30 in. by 13 ft. 9 in., that is used for examining the chronograph rolls and the writing of reports. The four windows in the side of the car immediately above this table provide excellent illumination for working on the rolls. Under this table at each end are a tier of drawers and two small lockers which are used for storing data, drawing instruments, blue prints, etc. Above the work table at one end is an emergency upper berth that may be used when required. Four lockers above the other end supply storage space for clothing of the crew.

Opposite the computing table is a flat-top desk with large drawers at each end. The windows provide illumination for the desk, and immediately above them is a large book case with sliding glass doors. Artificial illumination is supplied by means of electric lights suspended from the ceiling, a row of lights with reflectors mounted on the wall above the computing table and two movable desk lights. Two 12-in. electric fans, sash ventilators, and two Utility exhaust ventilators provide proper ventilation in the work room.

The Dynamometer Room

The dynamometer room occupies the forward end of the car and is 17 ft. 5 in. long. The chronograph table is located approximately in the middle of this room. In the left rear corner is an oak work bench with ⅛-in. steel top and a bench vise. A tool rack at one end of the bench supports the necessary wrenches, etc. A small steel tool box that is bolted to the floor immediately below the bench provides further storage space for miscellaneous tools. On each side of the dynamometer are lockers made of oak that measure 18 in. by 6 ft. and extend from the floor to the ceiling. These lockers are conveniently divided for storing equipment. Those on the right include four individual overall lockers, two gage lockers with adjustable shelves spaced every five inches, one locker for storing temperature recorders, and one locker containing adjustable shelves for miscellaneous equipment such as draft tubes, manometers, gage testers, coal-sampling jars, etc. The lockers on the opposite side are also equipped with adjustable shelves and provide storage space for paper rolls, brooms, shovels, lanterns, signal flags, oil, etc. A reel is provided on the end of this tier of lockers to support the 12-wire signal cable used between the dynamometer car and locomotive. Additional lockers are built into the space immediately above the sliding end

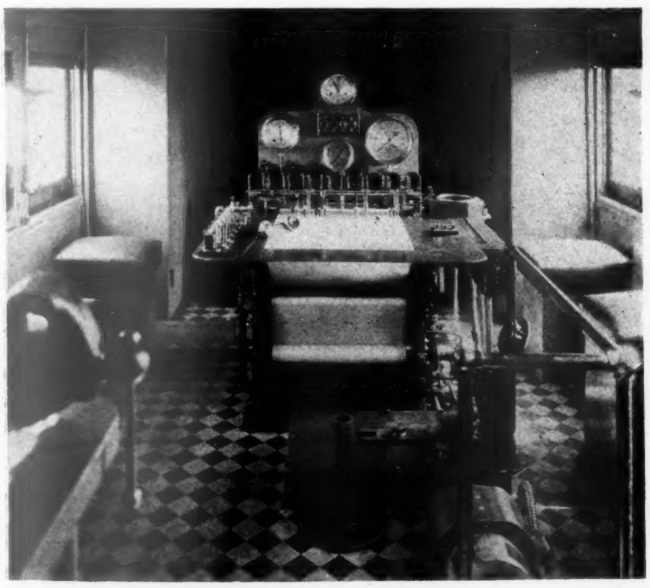
door and extend the full width of the dynamometer car.

There are two seat cushions covered with brown imitation leather and with boxes below for storage at each side of the chronograph table. Two of the seats are used by visitors and the other two by those taking observations. The observers' windows provide clear vision along the side of the train and may be readily removed by loosening thumb screws. A divided drop window slides into place when the portable window is removed. Immediately forward of the observers' seats on each side of the car are located drop leaf table shelves which are used while making notes and reading profile maps. An adjustable electric spot light is located in each observation window and used for locating mile posts, etc., at night.

Natural illumination of the dynamometer room is accomplished by two sliding windows, two swinging side-door windows, and the sliding end-door window. Three suspended ceiling lights, and three wall mounted lights with reflectors give excellent artificial illumination.

This room is well ventilated by the aid of two intake ventilators, two exhaust ventilators, and a 12-in. electric fan which is mounted above the sliding end-door.

A 1-½-kw. Kohler farm-lighting plant, which is located under the work bench where it is protected and out of the way, is used to charge the storage batteries. The battery equipment consists of two sets of 225-amp.-hr., 32-volt storage batteries, used separately, which are hung in a single battery box below the car. The switchboard locker is located in the rear right hand corner of the dynamometer room and the circuits are so arranged that while one set is being charged the other may be used to furnish light and power. If both batteries should be discharged to such an extent that they

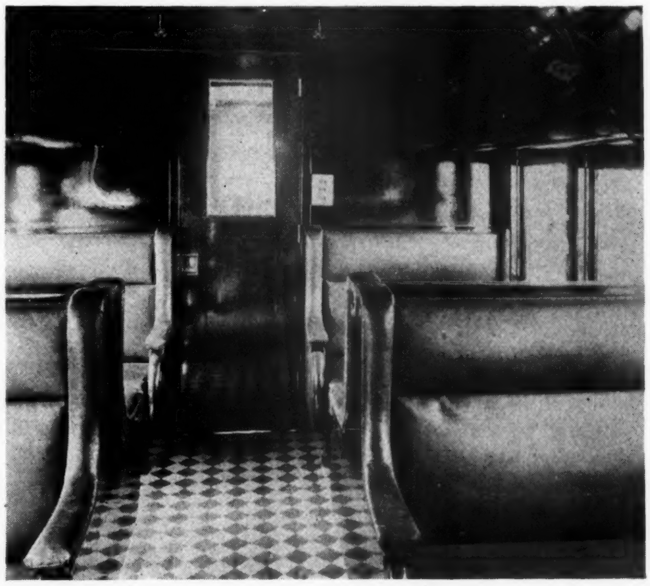


The chronograph table

could not be used, electric power may be taken directly from the generator of the Kohler unit. It is also possible to obtain electric current from the train line whenever the car is used in passenger-train service. Both battery sets are also equipped with charging receptacles that are used whenever the car is stationed at terminals where charging plants are available.

On the left side of the car between the dynamometer room and the lavatory is the heater room. It is thoroughly lined with galvanized iron and has double doors that open towards the aisle. The car is heated by a hot-water system, heat being obtained either by fire in the Baker heater or by steam from the train line which enters a water jacket at the rear of the Baker heater. An overhead hot-water tank for the lavatory is hung in the heater room.

The weighing head, which is rigidly bolted to the car underframe, is located on the center line of the car immediately forward of the chronograph table. It is



Four berth sections in new dynamometer car

of the diaphragm type with a drawbar pull piston at the rear and the buff piston at the front. The diaphragms are of rubber, and glycerine is used as the medium for transmitting the pull to the drawbar pull indicator. The yoke in the weighing head gives a three to one ratio between the center line of the draft gear and the knife edge contacts at the center of the weighing head. The draft gear connection and fulcrum in the vertical yoke between the drawbar and the weighing head have roller bearings. The weighing head pistons are supported by suspension bearings and the pistons may be locked in central position by the use of jack screws.

The paper drive is taken from the rear axle of the front truck through an axle worm and worm wheel with a vertical shaft which extends up to the speed change box that is located on the floor near the chronograph table. By means of this speed change box, three paper speeds can be obtained from the axle drive, that is, ¼ in., ½ in., and 1 in. per 100 ft. of car travel. The speed recorder motor can also be used to drive the paper, whether the car is in motion or not. By meshing the proper gears in the speed change box, the paper may be driven from the motor at a constant speed of 7-½ in., 15 in., or 30 in. per min., and at the same time have the speed recorder register the actual speed at which the car is traveling.

Chronograph Table Uses 22-in. Roll

The chronograph table roll is 22 in. wide, and the bridge bar spanning the table supports all the recording fountain pens. The events recorded by the pens from right to left are as follows: Location line; cab records, such as throttle and reverse lever position; drawbar

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Locomotive Back Pressure

Analysis of the laws governing steam flow through the exhaust nozzle and their relation to back pressure

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SINCE the laws governing the flow of steam are well known, it occurred to the writer that this knowledge might be applied to the flow of steam through the exhaust nozzle of a locomotive, particularly if the exhaust passages are of ample area and have no sudden bends, chokes, or restrictions from the valve chamber to the exhaust-nozzle tip. It is reasonable to believe that, taking any locomotive and not changing the exhaust nozzle, the flow of steam through the nozzle would be the same for a given back pressure and temperature observed in the exhaust passage, regardless of variables such as speed, cut off, valve-chest pressure and superheat.

Accordingly, the test results of two locomotives—Missouri Pacific No. 1699 and Baldwin No. 60000—were studied and calculations made for the flow of steam through the exhaust nozzle. The calculated results were then compared with the actual results. The test results of the Baldwin locomotive No. 60000 appeared in the January, 1927, issue, page 8, while the test results of the Missouri Pacific locomotive No. 1699 were published in the July, 1925, issue of the *Railway Mechanical Engineer*, page 465. Both locomotives were tested on the Pennsylvania test plant at Altoona, Pa.

Flow of Steam From Higher to Lower Pressures

When steam flows from a reservoir into a region of lower pressure through a nozzle the flow may be considered as adiabatic. Applied to a locomotive, the exhaust passages may be considered the reservoir while the interior of the smoke box may be considered as the region of lower pressure. For all calculations the pressure within the smoke box has been assumed as equal to 14.7 lb., per sq. in. absolute. Actually the pressure is less than atmospheric and the atmospheric pressure varies, but the calculated results for locomotive No. 60000 using the exact barometric pressure and smoke box vacuum gave results no closer to the actual than the straight assumption of a constant barometric pressure of 14.7 lb., per sq. in. and the smoke box vacuum was neglected. The labor of calculating was greatly reduced by this assumption.

Table I—Flow of Dry Saturated Steam Through a Nozzle Having a Net Area of One Square Inch

Pressure, lb. per sq. in. Exhaust pipe		Pressure, lb. per sq. in. Discharge		B.T.U. per lb. steam		B.T.U. converted into velocity	Quality after adiab. expansion	Spec. volume after adiab. expansion	Jet velocity, ft. per sec.	Flow, lb. per hr.
Gage P_0	Absolute P_1	Absolute P_2	Entropy	Exhaust pipe i_1	After adiabatic exp. i_2	(i_1-i_2)	X	V_2		
1	15.7	14.7	1.7537	1153.0	1148.2	4.8	.9964	26.71	490.1	458.66
2	16.7	14.7	1.7487	1154.2	1144.9	9.3	.9930	26.62	682.2	640.65
3	17.7	14.7	1.7441	1155.4	1141.8	13.6	.9898	26.54	825.0	777.23
4	18.7	14.7	1.7397	1156.4	1138.8	17.6	.9867	26.45	938.5	886.90
5	19.7	14.7	1.7355	1157.4	1136.0	21.4	.9838	26.38	1035.0	980.85
6	20.7	14.7	1.7316	1158.4	1133.4	25.0	.9811	26.30	1118.5	1063.0
7	21 7	14.7	1.7278	1159.3	1130.8	28.5	.9785	26.23	1194.2	1138.1
8	22.7	14.7	1.7242	1160.2	1128.4	31.8	.9760	26.17	1261.5	1205.3
9	23.7	14.7	1.7207	1161.0	1126.0	35.0	.9736	26.10	1323.5	1267.6
10	24.7	14.7	1.7174	1161.9	1123.8	38.1	.9713	26.04	1380.8	1325.6
11	25.7	14.7	1.7142	1162.6	1121.7	40.9	.9691	25.98	1430.6	1376.6
12	26.7	14.7	1.7112	1163.4	1119.7	43.7	.9670	25.93	1478.8	1426.0
13	27.7	15.2	1.7083	1164.1	1120.2	43.9	.9667	25.12	1482.2	1474.8
14	28.7	15.8	1.7054	1164.8	1120.9	43.9	.9668	24.24	1482.2	1528.8
15	29.7	16.3	1.7027	1165.5	1121.3	44.2	.9665	23.53	1487.2	1579.9
16	30.7	16.9	1.7000	1166.1	1122.1	44.0	.9665	22.75	1483.9	1630.5
17	31.7	17.4	1.6975	1166.7	1122.4	44.3	.9663	22.14	1488.9	1681.4
18	32.7	18.0	1.6950	1167.3	1123.2	44.1	.9663	21.43	1485.6	1732.8
19	33.7	18.5	1.6925	1167.9	1123.4	44.5	.9660	20.89	1492.3	1785.5
20	34.7	19.1	1.6902	1168.5	1124.0	44.5	.9660	20.28	1492.3	1840.0
21	35.7	19.6	1.6880	1169.1	1124.4	44.7	.9658	19.80	1495.6	1888.5
22	36.7	20.2	1.6858	1169.6	1125.0	44.6	.9658	19.24	1494.0	1941.4
23	37.7	20.7	1.6836	1170.2	1125.3	44.9	.9656	18.80	1499.0	1993.3
24	38.7	21.3	1.6815	1170.7	1126.0	44.7	.9656	18.30	1495.6	2043.4
25	39.7	21.8	1.6794	1171.2	1126.1	45.1	.9653	17.90	1502.3	2098.7

Formula used to solve for flow:

$$M = A \frac{223.7\,(i_1 - i_2)^{1/2}}{V_2}$$

M = Flow lb. per sec.
A = Area of nozzle, sq. ft.
i_1 = B.T.U. per lb. steam—Exhaust pipe.
i_2 = B.T.U. per lb. steam—After adiabatic expansion.
V_2 = Specific volume after adiabatic expansion, cu. ft. per lb.

Assumed:
14.7 lb. per sq. in. = Atmospheric pressure.
Flow of steam is adiabatic and frictionless.
Coefficient of discharge = 1
14.7 lb. per sq. in. = P_2 when $P_2 > .55P_1$
$55P_1 = P_2$ when $P_2 < .55P_1$

Table I is worked out for the flow of dry saturated steam through a nozzle having a net cross-sectional area of one square inch with back pressures up to 25 lb., per sq. in. It will be noted that the column headed discharge pressure corresponds with the smoke box pressure up to the point where the critical pressure is reached. The critical pressure is reached when 0.55 times the back pressure is greater than 14.7 lb. per sq. in. For back pressures higher than the critical the discharge pressure used for the purpose of calculation equals 0.55 times the back pressure. The heat content and entropy of a pound of steam in the exhaust passages is found in the steam tables. The flow being adiabatic, the entropy remains constant and the heat per pound of steam is found corresponding to the discharge pressure. The heat lost during the expansion all goes into giving the jet velocity. Sheet *A* shows the formula and explains the symbols. Goodenough's steam tables were used to find the properties of steam. The last column shows the flow of dry saturated steam through a nozzle having an area of one square inch. In order to apply these results to a locomotive in which the steam in the exhaust passages is dry saturated or slightly superheated it is only necessary to multiply by the net cross-sectional area of the nozzle.

Table II—Flow of Dry Saturated Steam Through a Nozzle Having a Net Area of One Square Inch, Calculated by Grashof's Formula

Pressure, lb. per sq. in. Exhaust pipe Gage P_G	Pressure, lb. per sq. in. Exhaust pipe Absolute P_1	Pressure, lb. per sq. in. Discharge Absolute P_2	P_2/P_1	K	$P_1^{.97}$	Steam flow, lb. per hr.
1	15.7	14.7	.9363	.5294	14.455	459.18
2	16.7	14.7	.8802	.6993	15.348	643.96
3	17.7	14.7	.8305	.8026	16.238	781.98
4	18.7	14.7	.7861	.8713	17.127	895.38
5	19.7	14.7	.7462	.9184	18.015	992.70
6	20.7	14.7	.7102	.9507	18.906	1078.5
7	21.7	14.7	.6774	.9728	19.786	1154.9
8	22.7	14.7	.6476	.9870	20.670	1224.1
9	23.7	14.7	.6203	.9955	21.553	1287.4
10	24.7	14.7	.5951	.9995	22.435	1345.4
11	25.7	See note.			23.315	1398.9
12	26.7				24.194	1451.6
13	27.7				25.073	1504.4
14	28.7				25.950	1557.0
15	29.7				26.828	1609.6
16	30.7				27.703	1662.2
17	31.7				28.578	1714.7
18	32.7				29.451	1767.1
19	33.7				30.325	1819.5
20	34.7				31.176	1870.6
21	35.7				32.069	1924.1
22	36.7				32.941	1976.4
23	37.7				33.810	2028.6
24	38.7				34.680	2080.8
25	39.7				35.549	2133.0

Grashof's Formula:

$M = 60AP_1^{.97}$ when $P_2 < .58P_1$

$M = K60AP_1^{.97}$ when $P_2 > .58P_1$

$K = 2.182\sqrt{n(1-119n)}$ and $n = (1-P_2/P_1)$

M = Flow in lb. per hr.

A = Area of nozzle in square inches.

P_1 = Exhaust pipe pressure, lb. per sq. in. absolute.

P_2 = Discharge pressure, lb. per sq. in. absolute.

For superheated steam: Divide by $(1 + 0.00065T_s)$, where T_s = degrees superheat.

Note—P_2, P_2/P_1 and K do not enter into the formula when $P_2 < .58P_1$

Steam Flow Calculated by Grashof's Formula

Table II serves the same purpose as Table I only the results were worked out by using Grashof's formula. For the same conditions the results are a little higher using this method. Grashof's formula is in a form which makes it simple to correct for the superheat in the exhaust. The last column of Table II may be applied to a locomotive the same as the last column of Table I. If the steam in the exhaust passages is superheated, it is only necessary to divide by the factor

$$1 + 0.00065T_s$$

where T_s equals the degrees of superheat in the exhaust. The curve on the chart shows the results of Table II graphically.

Table III shows the actual and calculated flow of steam through the exhaust nozzle of Baldwin locomotive No. 60000. In these calculations a constant barometric pressure of 14.7 lb. per sq. in. was assumed, but the temperature of the exhaust was used. The calculations are similar to those in Table I and the calculations in that table could have been applied to Table III with the same results except in those cases where the steam in the exhaust passages is superheated enough to reduce the flow. It will be noted that superheat reduces the flow.

Table III—Actual and Computed Flow of Steam Through the Exhaust Nozzle of Baldwin Locomotive No. 60000

Test No.	Exhaust pipe pressure, lb. per sq. in. Gage	Exhaust pipe pressure, lb. per sq. in. Absolute	Temperature of steam in exhaust pipe, deg. F.	Discharge pressure, lb. per sq. in. Absolute	Entropy	B.t.u. per lb. steam Exhaust pipe	B.t.u. per lb. steam After adiab. expansion	Spec. volume after adiabatic expansion	Steam to engines, lb. per hr.	Steam carried from loco. cyl. at heater, lb. per hr.	Actual steam through nozzle, lb. per hr.	Calculated steam through nozzle, lb. per hr.	Difference, actual and calculated	Per cent difference
7912	2.1	16.8	220	14.7	1.7491	1155.0	1145.1	26.63	21,882	2,025	19,857	21,940	+2,083	+10.50
7910	2.8	17.5	222	14.7	1.7459	1155.7	1143.0	26.57	26,740	2,583	24,157	24,904	+ 747	+ 3.09
7911	4.0	18.7	228	14.7	1.7423	1158.2	1140.6	26.50	32,003	3,185	28,818	29,390	+ 572	+ 2.04
7906	6.2	20.9	232	14.7	1.7326	1159.5	1134.0	26.32	38,863	4,264	34,599	35,620	+1,021	+ 2.94
7922	9.5	24.2	257	14.7	1.7321	1170.7	1133.7	26.31	49,485	5,500	43,985	42,920	—1,065	— 2.42
7917	2.7	17.4	222	14.7	1.7465	1155.8	1143.4	26.58	26,512	2,638	23,874	24,600	+ 726	+ 3.04
7914	3.0	17.7	226	14.7	1.7473	1157.6	1143.9	26.60	33,453	3,542	29,911	25,840	—4,071	—13.62
7913	6.3	21.0	235	14.7	1.7335	1160.9	1134.6	26.34	41,376	4,517	36,859	36,150	— 709	— 1.92
7907	11.1	25.8	248	14.7	1.7183	1165.8	1124.4	26.06	49,763	5,562	44,201	45,846	+1,645	+ 3.59
7908	11.4	26.1	253	14.7	1.7204	1168.2	1125.8	26.10	52,084	5,833	46,251	46,330	+ 79	+ 0.17
7919	17.2	31.9	286	17.5	1.7191	1183.0	1137.6	22.37	66,156	8,275	57,881	55,915	—1,966	— 3.40
7918	3.5	18.2	224	14.7	1.7425	1156.4	1140.7	26.51	29,339	2,979	26,360	27,755	+1,395	+ 5.29
7915	6.3	21.0	236	14.7	1.7342	1161.3	1135.1	26.35	38,525	4,079	34,446	36,063	+1,617	+ 4.69
7916	9.9	24.6	254	14.7	1.7282	1169.1	1131.1	26.24	49,046	5,428	43,618	43,616	— 2	0.0
7926	9.1	23.8	257	14.7	1.7341	1170.9	1135.0	26.35	48,323	5,359	42,964	42,218	— 746	— 1.74
7909	16.2	30.9	286	17.0	1.7229	1183.3	1138.1	23.00	62,952	7,389	55,563	54,270	—1,293	— 2.33
7924	8.6	23.3	286	14.7	1.7560	1185.1	1149.8	26.76	44,147	4,939	39,208	41,230	+2,022	+ 5.16
7925	14.2	28.9	317	15.9	1.7507	1198.9	1152.0	24.88	59,931	7,006	52,925	51,113	—1,812	— 3.42
7923	19.8	34.5	308	19.0	1.7242	1193.3	1147.0	20.88	67,456	8,308	59,148	60,513	+1,365	+ 2.31
7927	19.7	34.4	313	18.9	1.7277	1195.8	1149.0	21.03	68,348	8,602	59,746	60,393	+ 647	+ 1.08
7928	1.7	16.4	218	14.7	1.7505	1154.1	1146.1	26.65	22,612	2,117	20,495	19,702	— 793	— 3.86
7929	4.6	19.3	228	14.7	1.7386	1158.0	1138.1	26.43	33,994	3,571	30,423	31,334	+ 911	+ 2.99
7920	4.8	19.5	228	14.7	1.7374	1157.9	1137.3	26.41	32,854	3,356	29,498	31,904	+2,406	+ 8.16
7921	3.2	17.9	223	14.7	1.7438	1156.0	1141.6	26.53	27,387	2,826	24,481	26,557	+2,076	+ 8.49
7930	7.8	22.5	251	14.7	1.7367	1168.3	1136.8	26.40	42,092	4,597	37,495	39,475	+1,980	+ 5.27

Formula used to solve for flow of steam:

$$M = A\,\frac{\left[223.7\,(i_1-i_2)\right]^{1/2}}{V_2}$$

Area of nozzle = 33.2 sq. in.

See Table I for symbols used in this formula.

Assumed:

14.7 lb. per sq. in. = Atmospheric pressure.

Steam flow is adiabatic and frictionless.

14.7 lb. per sq. in. = P_2 when $P_2 > 0.55P_1$

$.55P_1 = P_2$ when $P_2 < 0.55P_1$

Table IV shows the actual and computed flow of steam through the exhaust nozzle of Baldwin locomo-

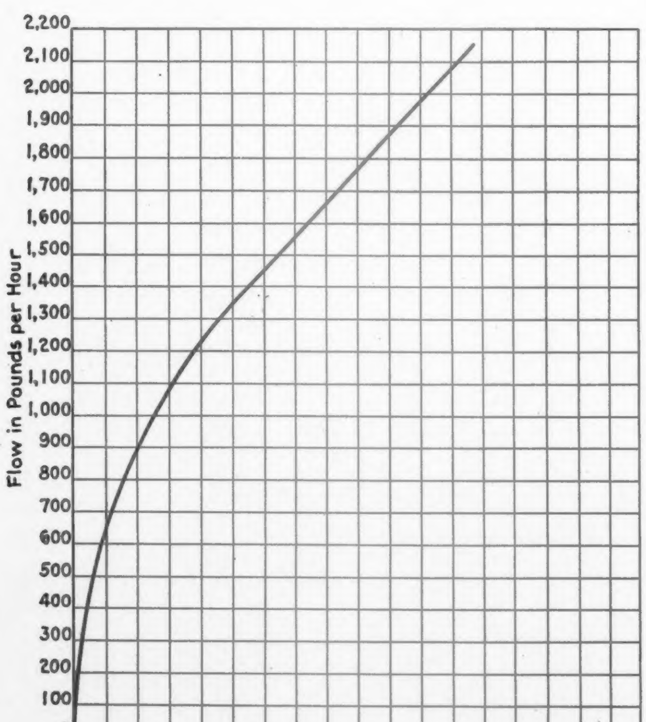
tive No. 60000 computed by taking the values from Table I and Table II and merely multiplying by the area of the nozzle. The temperature of the steam in the exhaust passages is neglected when the values from Table I are used but the values from Table II are corrected for the superheat in the exhaust.

Table IV—Actual and Calculated Flow of Steam Through the Exhaust Nozzle of Baldwin Locomotive No. 60000

Test No.	Exhaust Pipe: Pressure, lb. per sq. in., gage	Exhaust Pipe: Temperature, deg. F.	Exhaust Pipe: Superheat, deg. F.	Actual steam through nozzle, lb. per hr.	Calculated steam through nozzle, lb. per hr., Table I	Calculated steam through nozzle, lb. per hr., Grashof's formula
7912	2.1	220	4	19,857	21,723	21,781
7910	2.8	222	3	24,157	24,897	24,997
7911	4.0	228	6	28,818	29,445	29,611
7906	6.2	232	4	34,599	35,790	36,219
7922	9.5	257	19	43,985	43,060	43,171
7917	2.7	222	3	23,874	24,445	24,539
7914	3.0	226	7	29,911	25,803	25,844
7913	6.3	235	7	36,859	36,055	36,402
7907	11.1	248	8	44,201	45,882	46,377
7908	11.4	253	11	46,251	46,347	46,809
7919	17.2	286	32	57,881	56,174	56,109
7918	3.5	224	2	26,360	27,626	27,808
7915	6.3	236	5	34,446	36,055	36,449
7916	9.9	254	16	43,618	43,824	44,017
7926	9.1	257	21	42,964	42,264	42,356
7909	16.2	286	36	55,563	54,481	54,264
7924	8.6	286	50	39,208	41,268	40,582
7925	14.2	317	71	52,925	51,095	49,746
7923	19.8	308	50	59,148	60,726	59,820
7927	19.7	313	55	59,746	60,557	59,469
7928	1.7	218	2	20,495	19,457	19,514
7929	4.6	228	3	30,423	31,317	31,604
7920	4.8	228	3	29,498	31,939	32,249
7921	3.2	223	4	24,481	26,532	26,645
7930	7.8	251	18	37,495	39,570	39,716

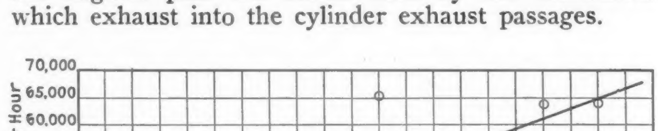
Calculated steam through the nozzle is by the method shown in Table I. The A-values from Table I are interpolated and the temperature is neglected. In calculating the steam through the nozzle by Grashof's formula, the values from Table II are interpolated and are corrected for superheat in the exhaust. Area of exhaust nozzle, 33.2 sq. in.

Table V has been worked out for the Missouri Pacific locomotive No. 1699 in exactly the same manner that Table IV has been worked out for Baldwin locomotive No. 60000.



Flow of dry saturated steam through a nozzle of 1 sq. in. net cross-sectional area calculated by Grashof's formula

In the case of injector-fed locomotives, all of the steam to the engines passes out through the exhaust nozzle. The exhausts from many of the auxiliaries may be piped to the exhaust passages also. In this case the steam through the nozzle equals the steam to the engines plus the steam used by the auxiliaries which exhaust into the cylinder exhaust passages.



Curve calculated from Grashof's formula for flow of dry saturated steam—Missouri Pacific locomotive No. 1699 —The exhaust nozzle area is 35.67 sq. in.

In the case of locomotives equipped with feedwater heaters, the steam used to heat the feedwater does not pass through the exhaust nozzle and the steam through the nozzle equals the steam to the engines plus the steam used by the auxiliaries which exhaust into the cylinder exhaust passages minus the steam drawn from the exhaust passages for feedwater heating.

The calculated results may be expected to vary from the actual results for several reasons. When the speed is low the fluctuating back pressure makes a true back pressure reading practically impossible. An error in

Table V—Actual and Calculated Flow of Steam Through the Exhaust Nozzle of Missouri Pacific Locomotive No. 1699

Test No.	Exhaust Pipe: Pressure, lb. per sq. in., gage	Exhaust Pipe: Temperature, deg. F.	Exhaust Pipe: Superheat, deg. F.	Actual steam through nozzle, lb. per hr.	Calculated steam through nozzle, lb. per hr., Table I	Calculated steam through nozzle, lb. per hr., Grashof's formula
6901	3	227	6	23,540	23,845	23,898
6902	3	224	3	23,285	23,845	23,944
6903	3	231	10	23,219	23,845	23,836
6904	11	296	54	41,824	42,234	41,463
6905	4	258	34	27,668	27,210	26,877
6906	5	293	66	32,977	30,092	29,204
6909	11	270	28	55,294	52,972	52,868
6910	8	294	59	47,148	46,380	45,361
6911	7	317	85	39,552	43,794	42,111
6912	8	325	90	44,555	46,380	44,111
6913	12	366	122	53,566	54,872	51,756
6914	13	366	120	51,532	56,904	53,701
6915	8	355	120	43,779	46,380	43,695
6916	11	312	70	48,216	49,103	47,726
6917	17	360	106	59,601	59,976	57,219
6918	5	270	43	34,931	34,987	34,445
6919	7	333	101	43,587	40,596	38,654
6920	8	297	62	41,223	42,993	41,971
6921	12	328	84	51,438	50,865	49,099
6922	5	260	33	34,003	34,987	34,620
6923	19	374	116	59,398	63,689	60,350
6924	13	376	130	51,982	52,606	49,480
6925	5	335	108	33,676	34,987	33,087
6926	11	346	104	61,112	49,103	46,738
6927	3	222	1	23,832	27,724	27.874
6928	10	337	98	47,232	47,286	45,116

Tests No: 6901 to 6906, inclusive, 6¼-in. dia. with plain tip, area 30.68 sq. in.

Tests No. 6909 to 6915, inclusive, 7-in. dia. with basket bridge. Area, 38.48 sq. in. with area of bridge neglected.

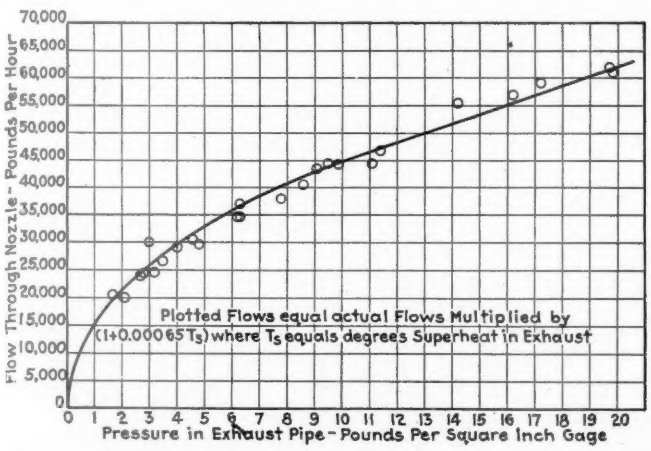
Tests No. 6915 to 6928, inclusive, 7-in. dia. with Goodfellow tip. Net area, 35.67 sq. in.

Assumed atmospheric pressure, 14.7 lb. per sq. in.

the observed back pressure will result in a high per cent error of flow when the steam consumption and resulting back pressure are low, for the calculated change of flow with respect to back pressure is high with low back pressure. One side of the engine may be using more steam than the other and the back pressure gage connection may be so located that the gage is reading the back pressure from one side only. The connection to the exhaust passage from the gage may be so located or of such form that the velocity of the steam in the exhaust passage affects the back-pressure reading considerably.

An examination of Tables III and IV will show that the actual and computed flows for Baldwin locomotive No. 60000 are in close agreement with the exception of a few tests.

In Table V, showing the tests of the Missouri Pacific locomotive No. 1699, Tests 6907 and 6908 were omitted. Test 6907 was run with a basket bridge and it was not clear from the report in the *Railway Mechanical Engineer*, July, 1925, as to what nozzle was used for Test 6908. In calculating Tests 6909 to 6915, the area of the basket bridge was neglected. There is probably a typographical error in the back pressure for



Curve calculated from Grashof's formula for flow of dry saturated steam—Baldwin locomotive No. 60,000 —The area of exhaust nozzle is 33.2 sq. in.

Test 6926. Test 6923 shows a smaller flow with a back pressure of 19 lb. per sq. in.

Conclusions

It is believed that this study presents back pressure in a way that it is not often looked upon. That is, the gage may be considered a flow meter as well as a back-pressure gage. Knowledge of the flow at any instant would be of great value during a locomotive road test, especially if indicator cards were being taken. However, with modern locomotives the superheat in the exhaust runs high at certain loads and speeds, and strictly speaking, in order to calculate the flow it is necessary to know the temperature as well as the pressure in the exhaust passages. Taking a constant back pressure, as the superheat increases the flow decreases, but by Grashof's formula it takes almost 16 deg. F. superheat to decrease the flow one per cent, and as the observations may be slightly in error, the temperature may be neglected in almost all cases and the calculated results be just as close to the actual results. A comparison of the results in Table III with the results in Table IV calculated by the method in Table I, will show the difference when the temperature is neglected.

It is well to say here that the methods outlined and used in this study will not give accurate results for all locomotives. The writer was unable to check several locomotives for which the test results were available, the actual flows being far below the calculated, which would lead one to conclude that the flow was unduly constricted in the exhaust passages or pipe.

Convention of the Air Brake Association

Final report of the meeting recently held in Chicago

A *REPORT* of the thirty-seventh annual convention of the Air Brake Association, which was held in Chicago, May 13 to 16, 1930, inclusive, appeared in the June, 1930, issue of the *Railway Mechanical Engineer*. Following are summaries of four reports which were presented at that convention, but were not included in the report published in the June issue:

Triple Valve Repairs—Maintaining Standards

The North West Air Brake Club presented a paper entitled "Triple Valve Repairs—Maintaining Standards" in which it was pointed out that there are three main objectives to be kept in mind in the maintenance of air brakes: First, highest efficiency and greatest reliability of operation possible to obtain; second, greatest length of time in good operating condition before making repairs, and, third, lowest cost of maintenance work consistent with securing the best service.

The paper gave a list of and discussed some of the mutilations of triple-valve parts during the process of repair. This list included such items as lengthening the exhaust cavities in slide valves; bevelling off the face of the slide valve by filing or grinding at the end of the valve which comes in contact with the retarding stem; bevelling off the face of slide valve at the sides of the valve; bevelling the retarding stem at the point where it comes in contact with the slide valve; filing off the main piston stem which reduces the size of the stem under the slide-valve-spring pin; grinding or filing emergency pistons at the edges so as to give them a loose fit in their chambers; drilling holes through the emergency pistons of freight triple valves; reducing the diameter of the spider on the end of the main piston stem by filing or grinding; dishing the main pistons by exerting pressure or hammering on the short stem; enlarging the hole in the emergency piston in which the emergency valve stem fits which leaves a shoulder at the bottom; grinding or filing emergency-valve seats on the outer edges which causes them to fit too loosely in the recess in the check-valve case; filing the end of the short stem of the main piston where it comes in contact with the graduating stem so that the piston moves further before coming in contact with the graduating stem, and the use of repair parts which are not standard to the valve.

It was emphasized in the ensuing discussion of this paper that the most serious feature of the problem was that the repairmen and brake cleaners observed following these practices, as a rule, considered them to be good practices. Adequate instruction by supervisors

not to do such work and correcting errors by re-establishing standards, should eliminate these bad habits and others that develop from time to time because of the ingenuity of the men doing the work.

Training and Supervision of Air-Brake Employees

A committee consisting of J. A. Burke, E. Von Bergen, and F. C. O'Neill, supervisor of air brakes, Cleveland, Cincinnati, Chicago & St. Louis, presented a report on the training and supervision of air-brake employees. It was pointed out in the report that the greatest need at the present time is for a separate craft of air-brake mechanics. Boys who start in as apprentices should be selected for this craft and serve at least two years of their time in air-brake work.

The report dwelt largely on the qualifications of an air-brake supervisor. It stated that supervisors should be selected for their ability and should be energetic, active men. They should be expert at all classes of air-brake repair work and be able to demonstrate the best methods of securing both quantity and quality production. The air-brake supervisor should have authority over the maintenance and operation of the air-brake equipment in his territory, especially as the qualifications of employees assigned to this territory.

This paper aroused considerable discussion and it appeared to be the consensus of opinion that under present conditions intensive air-brake supervision is indispensable. One of the members stressed the fact that an air-brake supervisor should be assigned to each territory or division so that he could visit each shop and check up all classes of repair work, as well as the testing of valves and other brake equipment, at least once every two or three weeks. The need for exercising care in the selection of air-brake supervisors as to their ability and personality was also stressed by several of the speakers. The responsibility, one of the speakers stated, should be placed in the hands of the supervisor when deciding the qualifications of air-brake employees.

Brake-System Leakage

The St. Louis Air Brake Club presented a paper on brake-system leakage in which it made the following recommendations: Make permanent air-brake repairs when freight cars are on the repair tracks; reduce, or do not permit, leakage of more than 1 lb. per min., and be particular not to allow defective air hose, air-hose couplings or gaskets to be placed in service. It was suggested that the association recommend to the A.R.A. the adoption as standard practice the gaging of parts of all triple valves removed from cars with the tolerance gages specified by the Air Brake Association in 1925. It was also recommended that the association make a careful survey of the gages now in use with the object of recommending the adoption of such additional gages as may be required or to remove from the present set any gages found unnecessary. This recommendation referred especially to the first four gages in the set which are used for gaging triple-valve bushings to determine the correct size of lap-joint packing rings.

It was also recommended that a definite date be established after which all air-hose couplings must have the A.R.A. monogram to be accepted in interchange service. Six other recommendations were made in the paper; namely, periodical inspections of new air-hose couplings received from the manufacturer; authority to reject bills for the application of air-hose couplings not conforming to the A.R.A. specifications; adoption by the A.R.A. of specifications for the rubber used in the manufacture of air-hose gaskets; improve the present go and no-go air-hose-coupling gages; appointment of a committee from the association to investigate the application of the single-car tester when equipped with new air-hose gaskets to air hose having a worn gasket, due to the fact that the single-car tester under such conditions does not always indicate the leakage which later develops in actual service, and that a committee be appointed to investigate and determine upon some standard lubricant for angle and cut-out keys with a view of reducing or eliminating leakage and the maintenance expense encountered because of improper lubrication.

After considerable discussion, the recommendations contained in this paper were referred to the Executive Committee for its consideration and the appointment of the committees recommended in the paper.

U-12-B Universal Valve

The contribution of the Manhattan Air Brake Club to the convention program was a paper which described the U-12-B universal valve. This paper contained a large number of drawings and illustrations showing the operation and construction of this valve in which a quick-service feature has been incorporated. The quick-service operation is fundamentally the same as that of the ordinary type K triple valve in which a local venting of brake-pipe pressure to the brake cylinder occurs on each car. The operation is dependent upon the movement of the emergency piston which permits the graduating valve to vent brake-pipe air from the face of the emergency piston to the brake cylinder.

Convention of the Fuel Association

Final report of the twenty-second annual meeting

A report of the twenty-second annual convention of the Fuel Association, which was held at Chicago, May 6 to 9 inclusive, appeared in the June, 1930 issue of the *Railway Mechanical Engineer*. Following is a report which was presented at that convention but which was not published in the June issue:

Steam-Turbine Locomotives

At the conventions of this association for the years 1928 and 1929, this committee submitted reports covering the historical record and the detailed construction of all steam turbine locomotives which had been built. Each of these years a tentative general design for a steam-turbine locomotive was also submitted as a part of the report. This year, the committee decided to make a progress report covering the service, as far as possible, of all steam turbine locomotives now in actual operation in foreign countries.

From information recently received, the committee finds that there are only five steam turbine locomotives in actual service. Two of the five turbine locomotives are of the Zoelly design and use water-cooled surface condensers in connection with air-cooled evaporation-type water coolers.

One of these two locomotives is the Swiss standard

2-6-0 reciprocating type locomotive which was rebuilt to a 4-6-0 turbine drive of the Zoelly design. This is the original experimental locomotive of this type described in the technical press. It is still operating successfully near Zurich, Switzerland. The other turbine locomotive of this type is of the Zoelly-Krupp design built in Germany and is operating between Aachen and Hanover.

Three of the five turbine locomotives are of the Ljungstrom design, which use an air cooled surface condenser. One locomotive of this design and construction is in service in each of the following countries: Sweden, England and Argentine.

Advantages of Turbine Locomotives

The greatest advantages of the steam-turbine locomotive as now used are: Lower coal consumption, lower steam consumption and lower maintenance costs, with considerably greater availability for service. The greater availability is, in a great measure, due to the boiler feedwater being condensate which keeps the boiler clean and efficient at all times and the locomotive does not need to be held out of service for boiler washing.

The cost of the turbine locomotive will probably be from 25 to 50 per cent more than for the reciprocating type locomotive. The turbine locomotives now in service have a direct drive through gearing, between the turbine and the jack shaft, which in turn drives the driving axles by means of links or rods. The turbine bearings, gearing and shaft bearings are all kept flooded with oil and the wear on them is very slight as compared with the wear on pistons, crossheads, guides, valves, valve gear, etc., on a reciprocating type locomotive.

The size of the boiler on the turbine locomotive can be considerably smaller than for the reciprocating type locomotive because the turbine locomotive should use only about half the steam required for the reciprocating type locomotive. For the same reason the turbine locomotive should require only about half the coal used by the reciprocating type locomotive.

Why should the condensing type turbine driven locomotive be considered for use in this country?

First—To reduce the enormous dead weight of the locomotive. Many modern locomotives, including the tender, weigh 700,000 to 800,000 lb., of which 300,000 lb. or more is for the weight of the loaded tender tank. In other words, the tender alone, when loaded, weighs about as much as two Pullman cars, or two loaded 50-ton freight cars. The engine portion of the modern locomotive will weigh 400,000 to 500,000 lb. with only about 60 per cent of this weight on the driving wheels. Forty per cent of the weight of the locomotive plus the weight of the tender makes an enormous dead weight to be hauled.

With the air-cooled condenser only sufficient water need be carried to provide for leakage or heating passenger cars. With the surface condenser and evaporative type water cooler, it requires about .85 lb. of water to be evaporated to condense one pound of steam. This means that a considerable quantity of water must be carried for use in the evaporative type condenser. This water, however, need not be clean water as it is only used for evaporative cooling and is not used for boiler feed. This should reduce the water service costs considerably.

Second—To obtain full efficiency from the steam, it is necessary to provide a vacuum into which the reciprocating engine or turbine can be exhausted. When high-pressure steam is used at least two expansions are necessary. When this is done with a reciprocating engine, the low-pressure cylinders become too large and also an oily condensate is exhausted into the condenser and makes it inefficient. Oily condensate is also not desirable for boiler feedwater. The exhaust from a steam turbine is oil free and makes very desirable boiler feedwater.

Third—A turbine drive provides uniform starting or driving torque at all times, which is desirable. The turbine also eliminates all reciprocating parts which produce dynamic augment which is so undesirable for the locomotive itself or for track structures. The turbine locomotive can be fully balanced at all speeds and makes a better riding and better operating locomotive.

Fourth—The reduction in the amount of coal burned, under that necessary for a reciprocating type locomotive, leads the design toward the use of powdered coal.

Fifth—The control and auxiliary arrangement and details for a turbine locomotive with direct gear drive can be made simple and easy to operate.

Sixth—A turbine locomotive can easily be arranged for an electric generator and motor drive construction, with motors on as many axles as may be required to produce the necessary tractive power.

Seventh—A turbine locomotive can be constructed in one unit, thus eliminating as far as possible excessive weight and details now used between engine and tender, making for a better operating unit.

Sufficient information is now available to cover the design and construction of the turbine, driving gear and condensers for either the air-cooled or evaporative condenser for a turbine-driven locomotive.

The advantages to be gained by the use of this type of locomotive should be great enough to warrant construction in this country.

The report was signed by Chairman L. P. Michael, chief mechanical engineer, Chicago & North Western, Chicago; R. Ivan Andrews, engineer, England; C. H. Bilty, mechanical engineer, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; J. Crites, Combustion Engineer Corporation, Chicago; G. S. Goodwin, assistant to general superintendent of motive power, Chicago, Rock Island & Pacific, Chicago; V. G. Leach, Peabody Coal Company, Chicago; W. O. Moody, mechanical engineer, Illinois Central, Chicago; C. T. Perkins, Modine Manufacturing Company, Chicago; F. W. Peters, General Electric Company, Chicago, and W. M. Sheehan, General Steel Castings Corporation, Chicago.

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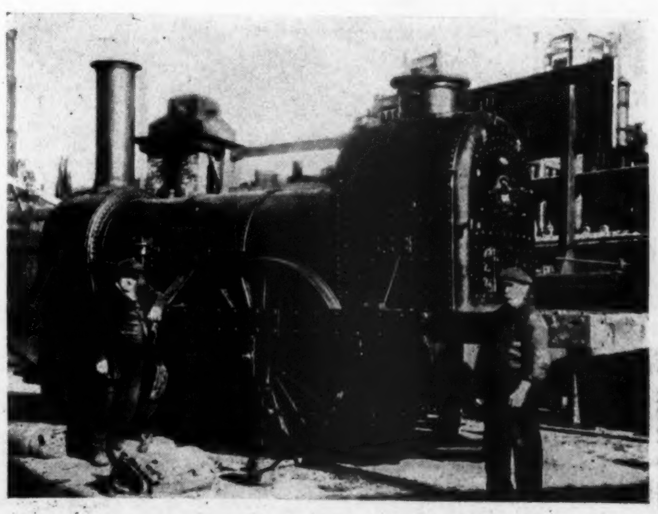


Wide World Photo

Locomotive "Lion" preparatory to being placed on exhibition by the Liverpool (England) Engineering Society

The Corrosion of Steel Freight Cars

(Continued from Page 396)

is removed as well as can be conveniently done, though in some cases a thorough sandblast is used. Among the essential properties of such a coating are an oily characteristic, sufficient penetration so that it will soak into rusted joints and permeate the hard rust scale, a filling and sealing material which will be carried into and under the scale by the more liquid ingredients and form a filler for open cavities, at the same time filling pits in the surface of plates, sealing all openings in seams and joints against water and other foreign materials. It must be impervious to the action of chemicals peculiar to the lading for which the car is used. When dry, it should remain tough and elastic.

A material of this kind should be applied by means of a good air spray, as this method of application gives far better results than is possible with brush application.

In some instances, a fair degree of success has been attained by using a crude oil as an interior spray. Where only a mild treatment is needed, this material is fairly satisfactory, and has the advantage of low cost.

New Milwaukee Dynamometer Car

(Continued from Page 399)

pull; drawbar pull zero; integrator offset; speed; speed zero; six second interval by motor; one minute line by clock; right side indicator; left side indicator; brake pipe pressure; brake pipe zero; one-in. paper travel.

Base line reference lines are necessary for the train line or brake pipe pressure, drawbar pull and speed. Fountain pens are also used to mark these base lines. At the forward end of the table is mounted the gage board which supports the clock, speed recorder gage, duplex air gage, drawbar pull gage, four signal lights and four relays. To the right of the instrument board and securely fastened to the table top are the integrator, drawbar pull cylinder and speed recorder. Mounted on the right side of the table and close to the operators' chair is the selective switch box with marked individual switches for each electrical circuit in the dynamometer room and those extending in the cable from the car to the engine. Telephones are used as a means of communication from the car to the cab.

On the left side of the table are six electrically operated counters, which are used to record the strokes of the air pumps, 100-ft. distance marks integrator offsets, six second intervals and each 100 lb. of coal delivered to the firebox. The coal is weighed in 100-lb. lots on platform scales mounted in the tender immediately over the stoker conveyor.

The speed recorder is the standard dynamometer car recorder made by the Baldwin Locomotive Works. The motor used to drive the recorder is a 30-volt, 1,750 r.p.m., ¾-hp. constant speed General Electric motor. Mounted on the end of the armature shaft is a governor that is used to hold the speed as close to 1,750 r.p.m. as possible. Further adjustment is obtained by a face plate rheostat. The motor is also used to drive the paper when desired. A small lever at the right side of the table controls the speed recorder, the speed device being in neutral when the lever is at its neutral position. When moved clear back, the true speed of the car is recorded, and when clear forward, double the car speed is shown. At both the observation windows are button switches for indicating location points.

A removable trap door in the floor over the draft gear in the kitchen end of the car is used in connection with draft gear tests. With the door removed, the gear may be inspected and gages mounted to collect data on the action of the particular gage undergoing test.

* * *

Carrollton viaduct, Baltimore & Ohio, Baltimore, Md.

EDITORIALS

Greater Comfort in Dining Cars

IN spite of the progress that has been made in the development of dining cars during the past 10 or 15 years, it cannot be said that the average diner, even the most modern ones, provides the maximum of comfort during the hot summer months or in hot climates. The ventilation of dining cars by means of ceiling or side wall fans serves to keep the air in motion in the car but the source of the greatest discomfort is the fact that there has, until now, been no efficient method of controlling car temperature and humidity. Some measure of relief has been provided in certain cases by opening the car windows but in spite of excellent screening it is almost impossible to keep fine cinders and dirt out of the cars. This adds much to the discomfort of the average diner. The Baltimore & Ohio dining car which was on exhibit at Atlantic City during the convention of the Mechanical Division, A.R.A., last month marks a step in the direction of providing greater dining-car comfort. Here is concrete evidence of the possibility of adequately ventilating and controlling the temperature and humidity of dining cars. Heretofore many railroad men have considered this a problem that did not lend itself readily to solution. The application of air conditioning to railroad equipment is by no means confined to dining cars. It promises much for future travel comfort in entire trains of passenger-carrying cars where uncomfortably high temperatures now make railroad travel at certain seasons something to be avoided in spite of the many attractions it offers in other respects.

Checking Material Expense

MOST general supervisors of railroad shops and enginehouses maintain a close daily check on expenditures for labor in order to make sure that monthly labor budgets may not be exceeded. Accurate records are also kept of material expenditures, but as a rule these records are maintained by the stores department and are not available to the shop supervision soon enough to serve as a guide in ordering material.

An interesting method of meeting this problem is now being used with marked success on the St. Louis-San Francisco. When a shop foreman or gang leader on this road needs certain material he fills out a material order and drops it in the nearest order box, from which it is delivered to a material foreman in the shop superintendent's or general foreman's office. This material foreman, with all the records before him, marks the price of the material in the proper column on the slip and sends the slip to the general foreman, who initials the order if the material expense for that day is not too high. A delivery boy takes the order to the stores department and, if the material is light in weight, loads it on a shop mule and delivers it at once to the foreman who originated the order. (Heavy material is, of course, delivered by a special gang with the requisite truck equipment.) If, however, material expenses are running unduly high, this method gives the general foreman a chance to hold back enough orders to keep within the desired limits of overall material expense. It need hardly be said that material urgently needed for shop operations is hardly ever held up, but it is a well-known fact that some shop foremen anticipate their material needs much further in advance than others and, in fact, much further than is necessary.

This method of checking daily material orders, while not excessively delaying the movement of necessary material to the shop, gives the general foreman control of the material expenses to the same extent that he has hitherto controlled expenditures for labor. Whether or not this particular system is used, it can hardly be questioned that, in the interest of efficient operation, some method should be provided for governing daily orders for material which constitute in the neighborhood of 40 per cent of maintenance-of-equipment costs.

What Power to Retire?

IN every period of reduced demand for power, railroads are confronted with the necessity of removing from active service and "white leading" certain locomotives. It then becomes a problem what locomotives to select, in the interests of maximum economy and efficient operation. In the words of R. E. Woodruff, vice-president of the Erie, in an address at the recent annual meeting of the International Railway Fuel Association, "The shop forces want to store the engines which are hardest to maintain because of peculiarities of design. The yardmaster wants to store the smallest engines because they do not clear his yard as quickly. The chief dispatcher wants the engines kept in service which make the best running time on the railroad. The engineman asks that engines be stored which ride the hardest. The road foreman wants the engines kept in service that burn the least coal."

Evidently numerous factors must be considered in arriving at an intelligent solution of this problem and some means must be found to reconcile the conflicting opinions. The general method followed by the Erie in the case of one division utilizing 10 different classes of freight locomotives was to conduct dynamometer tests and obtain figures of the cost of maintenance, wages and fuel on a gross ton-mile basis. These figures were then used as a basis for deciding which locomotives were most expensive to operate and should consequently be taken out of service first. Mr. Woodruff said that when the Erie did this it was the real beginning of fuel conservation on that road. By continuing the cost studies and extending them to other divisions, these figures gave a means of checking not only individual engine performance throughout the system, but the relative efficiencies of crews, which led to better road supervision. Maintenance conditions were improved because the fuel supervisors had something definite to take up with the shop forces. The test results and cost figures also emphasized the necessity of sufficient tonnage, without which no locomo-

tive or crew can make a satisfactory fuel performance.

It is axiomatic that reliable figures of individual locomotive performance in its various details is the governing factor in any intelligent decision regarding the white leading or the permanent retirement of motive power. Almost any amount of time and effort spent in securing this individual performance and cost data is well worth while.

Locomotive Lubrication

"THE pins and bushings of a valve gear equipped with an automatic oiling system were examined after 40,000 miles of service, found to be in good condition and were reapplied to the locomotive without any repairs." This excerpt from the report of the Committee on Lubrication of Locomotives of the Mechanical Division, A. R. A., is an example of what can be done by the effective lubrication of locomotive parts.

With the present-day extended locomotive runs it is too much to expect a few drops of oil, manually applied at irregular intervals, to lubricate the moving parts of the locomotive machinery effectively or to expect a dab of heavy grease to keep a hub liner cool. This type of lubrication causes pins rapidly to become shouldered or badly worn, pounding the bushing holes out-of-round, and makes necessary the dropping of wheels and the removal of driving boxes for repairs when they have run an inadequate number of service miles. Positive or pressure application of lubricants for shoes, wedges, hub liners, cross-head guides and shoes, valve-motion and side-rod pins offer the only means for effective lubrication where locomotives are assigned to runs twice or three times the length of those they were formerly required to make.

The pins and bushings of a valve gear probably receive less attention and lubrication than any other moving parts of the locomotive machinery. Intermittent drops of oil are fed to most of the valve-gear pins from a small cavity filled with hair and oil. That is, the oil is fed when the cavity is not filled with cinders and dirt, as is often the case. In other instances a small hole, drilled in the bearing above the pin, which can hold only a few drops of oil at the most is relied on to lubricate the pin regardless of the fact that the locomotive is required today to operate at high speeds over long distances without steps for "oiling around."

When the locomotive is in the roundhouse during inspection periods or in for minor light classified repairs, the valve motion parts are frequently stripped and removed to the shop for renewal of pins and bushings. The bushings are bored undersize so that they can be reamed to the correct pin size after being pressed in the rods. This is done to eliminate reaming or boring the bushing holes in valve gear that are pounded out-of-round by pins that become worn and shouldered as a result of insufficient lubrication. Shop practice of this nature obviously increases the maintenance costs for these parts.

Referring again to the report on the lubrication of locomotives, it states that tests have shown that any part of the locomotive equipped with a pressure grease system, except for the link block, will operate at least 1,000 miles between applications of grease. Such lubrication means a greater number of parts receiving constant lubrication, a reduction in wear, and a substantial saving in maintenance costs. With such proved performance before the railroads there is no doubt that if they are to reduce the cost of maintaining locomotives engaged in long-run operation, the oil can and hand oiling must be placed in the discard.

A Review of Engine Terminal Progress

WHEN the committee on shops and engine terminals presented its report to the Mechanical Division in 1928, the statement was made that "the maximum utilization of modern motive power cannot be obtained unless the engine terminals and the facilities in connection therewith are designed for rapid handling of locomotives. It must not be expected that antiquated terminals will do this." The engine terminal was not considered by the committee in its report at the convention held at Atlantic City last month. It may be worth while, as a reminder of the continuing importance of the engine terminal as a factor in locomotive operation, to record the progress that has been made in engine terminal design since the presentation of the committee's 1928 report.

Changed operating conditions have forced mechanical officers to devote more attention than was formerly the case to the design and equipment of their engine terminals, with the result that a remarkable decrease has been made in the time that it takes to turn locomotives at terminals. While it is true that a part of the efficiency of engine-terminal operation at the present time is due to more efficient forms of organization and the increased efficiency of the personnel, the engine terminal is probably one of the outstanding examples of the value of installing modern facilities. The study of the engine-terminal operation which appeared in last month's issue was made in an endeavor to determine what factors have had the greatest influence on increased engine-terminal efficiency. It developed the fact that electric drop tables, electric crane trucks, direct steaming, and modern machine-tool equipment, have contributed immensely to the fact that the maximum demands of traffic have been met, with a decrease in the ratio of locomotives assigned to locomotives dispatched. Modern facilities have made it possible to perform the major operations of engine-terminal maintenance in so much less time than formerly that it has been possible to effect a material increase in the number of locomotive dispatchments at modern terminals without a corresponding increase in the labor force.

There has been a decided change in the attitude of mechanical officers toward the engine terminal. Probably one of the most marked of these changes has been the attitude in relation to enginehouse machine tools. It was not so many years ago that the enginehouse machine shop was considered the natural dumping ground for machine tools that had outlived their usefulness in the back shop. The tendency now is, in view of the steadily increasing importance of running repair work, for many mechanical officers to specify new and relatively high grade machinery for installation in enginehouse machine shops, and to locate such machines in a well lighted shop, separated from the roundhouse proper, in a manner such that the machine tools will

not be subjected to the corrosive action of house gases.

The construction of many new terminals and the modernization of many more during the past two years is evidence of the fact that mechanical officers are alive to the importance of adequate terminal facilities, and it seems only fair at this time to give some of the credit for the progress that has been made in engine terminal design, to the work of the committee of two years ago in bringing to the Mechanical Division its recommendation for the design of such terminals.

Locomotive Counterbalancing

THE evil effects on track and bridges resulting from improper counterbalancing was recognized at a comparatively early stage in the development of the steam locomotive. At least fifty years ago it was a subject of discussion at conventions of the old Master Mechanics' Association. Despite the early recognition of the importance of the subject, the difficulties of applying practically the principles shown to be theoretically correct has helped to cloud the atmosphere to a considerable extent. Meantime driving-wheel loads have increased steadily from a maximum of 40,000 lb. which prevailed some 20 years ago to a common driving-wheel load of 60,000 lb. and a maximum of about 75,000 lb. found in designs of recent locomotives.

This increase has of course been accompanied by corresponding increases in weights of the parts which require counterbalancing. Moreover, increased piston thrusts have been accompanied by a greater overhang, while the diameter of the driving wheels has changed but little. Recently there has been a tendency to operate locomotives at higher speeds, largely in order to expedite the movement of freight traffic. Fortunately this change has been accompanied by an increase in driving-wheel diameter which gives space for greater counterweights and permits of their location at a more effective diameter.

The method employed in counterbalancing locomotives which has been quite generally followed is that contained in the recommendations made to the American Railway Association in 1915. Since then a most important contribution to the subject was made in the individual paper presented by C. T. Ripley in 1924 and in a Mechanical Division committee report of 1926. The report made at the Mechanical Division convention this year by the Committee on Locomotive Design and Construction is an outstanding contribution to this subject which was never of greater importance than at the present time. It is hoped that the paper not only will be filed for reference but that it will be studied carefully by those responsible for this essential feature of locomotive design.

A very practical part of the report which should not be overlooked is the appendix which outlines a method to be followed by shop forces in rechecking the counterbalance of the main wheels when the engine is cross-balanced as required to meet present conditions. As was stated by the committee, it is not only important that the initial counterbalancing be correct, but it is also essential that systematic inspection be made when engines are passed through the shop to assure a proper maintenance of such balancing.

That part of the committee's report dealing with counterbalancing will be the subject of an article in an early issue of the *Railway Mechanical Engineer*.

NEW BOOKS

OXY-ACETYLENE WELDING AND CUTTING. *By Stuart Plumley, chief engineer, Smith Welding Equipment Corporation, Minneapolis, Minn. Bound in cloth, 8 in. by 11 in., 302 pages, illustrated. Published by Universal Printing Company, 315 Fourteenth avenue, S. E., Minneapolis, Minn.*

The book is a text-book, arranged in a series of twenty lessons which cover all classes of welding. In the first four lessons, welding and cutting apparatus and equipment is discussed while the remainder of the test is confined to lessons dealing with the process of welding and cutting as applied to repair and construction work. Following each lesson a job sheet is arranged, providing for the reader a practical piece of work based on the material in the preceding lesson. This is in turn followed by a series of twenty questions to aid the reader in retaining the most important features set forth in the lesson he has just completed. The book, written for the skilled welder as well as the student, is well illustrated with more than 400 sketches and photographs to clarify the descriptive matter.

CENTENARY HISTORY OF THE LIVERPOOL & MANCHESTER RAILWAY. *By C. F. Dendy Marshall, M.A., Trinity College, Cambridge, England. Published by the Locomotive Publishing Company, Ltd., 3, Amen Corner, London, E. C., 4, England. Price $7.50.*

The author of this book is well-known in Great Britain and is becoming better known in this country as a writer of authority on railroad subjects. In addition to being a frequent contributor to British railway trade papers, he is the author of two well-known books, namely, "The Resistance of Express Trains" and "Two Essays in Early Locomotive History." This book is written in Mr. Marshall's interesting style and contains a large number of illustrations, one of which is a map of the Liverpool & Manchester, with a profile of the line which includes the one and one-half miles of track over which the Rainhill Trials were run. There are many illustrations in color, and in many respects the book is an excellent example of the printer's art.

The account given in this Centenary History of the Liverpool & Manchester is based on a careful study of every work included in the bibliography outlined in Chapter XIV. References are given for all of the more important statements, except such as either are unlikely ever to be questioned, or can be quite easily verified. There are fifteen chapters in the book and a profusion of illustrations, in colors, most of which are reproduced from originals in Mr. Marshall's collection. Other illustrations were loaned by Robert Stephenson & Co. from the book entitled "A Century of Locomotive Building."

Chapter I describes briefly the Liverpool & Manchester and its means of communication down to 1825; Chapter II, the state of railway development in 1825; Chapter III, the preliminaries; Chapter IV, the makers of the line; Chapter V, the construction; Chapter VI, the Rainhill Trials; Chapter VII, the opening day; Chapter VIII, the line as a going concern, and Chapters IX and X, the regular and supplementary locomotives. The remaining chapters discuss the builders of the locomotives, branch and connecting railways, the early views of the line and commemorative medals and miscellaneous objects of interest. The appendix contains a transcript of the relevant portions of Rastrick's "Rainhill" notebook.

THE READER'S PAGE

Welding Steel Plates on Driving Boxes

Lakeland, Fla.

To the Editor:

An illustration on page 281 of the May issue of the *Railway Mechanical Engineer* shows steel plates being welded on driving boxes. This is in an article entitled "Suggestions from Clearing" which shows different kinks used in the handling of locomotives at the Clearing, Ill., shops of the Belt Railway of Chicago.

From experience we have gained here we find that a steel liner cannot be successfully welded to a driving box with the acetylene torch. I note from the illustration that the crown brass has apparently been bored out or newly fitted. When the acetylene torch is used to weld a liner to a driving box, it will be pulled badly out of shape because of the shape of the box.

This not only makes it necessary to replace the driving box, but in most cases requires refitting the crown bearing. We have had good success in welding steel liners to driving boxes with the electric welder as the heat is confined to a very marked degree.

J. B. Hannah,
Foreman Locomotive Department, Atlantic Coast Line

More Reasons Why Coaches Ride Hard

Pittsburgh, Pa.

To the Editor:

In the April issue of the *Railway Mechanical Engineer,* R. R. Howarth asks, "Do you know why some cars ride hard?" I'll tell the world I do if the illustrations accompanying his article are trucks used under the cars from which he is receiving complaints. I wouldn't expect them to ride other than hard, especially the two shown on the first page of the article. They are a type of truck which one would expect to find under a car assigned to work-train or camp equipment and not under cars assigned to passenger service on a railroad which is particularly interested in the smooth riding of its equipment.

I presume that the party whom the author met and talked with in the diner and who remarked, "There is no rough track on this road" was a division engineer or a track supervisor. I don't believe any railroad has all smooth track, although no one in the maintenance-of-way department would admit otherwise.

Speaking of springs on dining cars on which the weight is unevenly distributed, he advises shimming up between the spring seats and the spring hangars. Wouldn't it be more logical to have the mechanical engineer or whoever prepared the car standards design a spring of greater flexibility for the dining end and one which would hold up under excess weight under the kitchen end rather than resort to equalizing or distributing the weight of the car by the shim methods?

Experience has taught me to ream out the holes in center plates and apply larger bolts where it is found that, "the center plate is sliding around in the bolster," as not only do the bolts wear but the center plate and the holes in the body bolster become elongated too and by merely tightening the bolts, or by replacing them with bolts of the same diameter, the trouble is only temporarily corrected.

Lubrication seems to have been entirely overlooked by Mr. Howarth in his article. Dry graphite seems to be the predominant lubricant for center plates on most railroads and a heavy oil lubricant is used on side bearings, chafing plates, pedestal slides, coupler carrier irons and buffer stems and plates. Lack of lubrication on these parts will cause more rough riding and annoying conditions than many of the causes mentioned by him.

Why have 2½ in. of clearance between the top of the equalizer bar and the bottom of the truck at the pedestal jaw as long as there is no indication of striking between these two points?

How about squaring up your car? By this I mean having the car ride perfectly level on the center plates and side bearings. In the photograph of the more modern truck, shown on page 219 of the April issue, it will be seen that about 4 in. of wood shims have been applied under one end of the truck equalizer, where it rests on the bolster, while on the other end there is only about 3 in. Many cars are found with 4- and 5-in. shims on one side and only from 1- to 2-in. on the opposite side of the car, both ends of the car being shimmed accordingly. This causes the car to be held in a twist and will cause a binding and grinding noise especially during high-speed operation.

I have enjoyed reading this article immensely and would like to read some of the comments which other car department men have to make about their methods of reducing the rough riding qualities of passenger equipment.

H. K. Allen.

Can Car Inspection be Standardized?

Akron, Ohio.

To the Editor:

There is no doubt that the author of "Inspecting the Main Tracker for Long Runs" has evolved a system of car inspection which will meet the demand on his railroad and perhaps some others but, inasmuch as the car-inspection question is so big, one man can know but little of the peculiar conditions which exist on different railroads. In fact, very few car-department officers know the true conditions on their own line. They may answer, "I know because I go out and work with my men on the job," but, in all probability, they only get around with one man a couple of days a month, there being dozens of jobs which they do not cover personally.

I agree with Mr. Howarth that inspection forces must be elastic and that hours must be changed frequently, especially where business conditions fluctuate and yard and road crews are changed often. A car foreman must wait until these changes are made before he can line up his forces to meet the new conditions which always de-

velop with such changes. Some roads permit cars which are to be used for commodity loading to be selected by conductors and switching crews while others card the cars for their respective commodities. A number of roads make their crews couple hose while others instruct car inspectors to do all this work in yard limits. Can any set force of men or any rules, therefore, govern all yard conditions?

As to the elimination of outbound inspection, I might ask where are most cars made defective? Not while they are standing, it is certain. Most of the defects develop in yard and hump switching. Pulling or kicking cars with the hand brakes tied down is the primary cause of most brake rigging failures which develop later while in transit. Broken yokes, yoke rivets, couplers, journal boxes and any number of minor defects can be added. I do not mean to infer that inbound inspection should be eliminated—far from it. The more inspection the better. A class *A* inspection should be given all interchange and inbound cars, but that does not mean that the car inspectors can go merrily on their way and never look at these cars again. The elimination of intermediate and outbound inspection is a problem to be balanced against the probability of accidents. Investigation will show that we still have too many accidents to warrant their discontinuance.

It is surprising to learn that some railroads allow their inspectors one and one-half to four hours on a train. I wonder how this would work out on a railroad where it is not unusual to deliver cars to a connecting line three or four miles away within seven hours after they have been spotted in an industrial plant for loading. During this time they must be inspected three times, placed for loading, loaded, pulled to break-up yard, switched and made up in a train and moved to the connection. What if the car inspectors had used four hours in this case?

FAIRFAX LENTZ.

Desirability of a Railroad Job

CHICAGO.

TO THE EDITOR:

I have read your editorial in the May issue, "What Makes a Job Desirable?", inspired by Mr. Howarth's letter on the Reader's Page. Whether or not Mr. Howarth has a "lack of specific information on the advantages of other industries," he has a remarkably clear conception of the probabilities of advancement in the railroad mechanical department.

It is, of course, obviously true that the progression rate of a given individual in any business depends largely upon the rate of development of the department of the industry in which he is engaged. But is it as obviously true that "for the present, at least, the railroads have reached a development of relative stability in which forces are neither increasing rapidly nor contracting rapidly?" To quote from your editorial again, I am inclined to believe that the above statement "itself indicates a lack of specific information on the subject." To be specific, I should like to ask: First, why are longer locomotive runs causing intermediate enginehouses all over the country to be discontinued? Do railroads in general increase the number of workmen and supervisors in the remaining enginehouses by adding all the men laid off at discontinued houses to the forces at the remaining houses? Second, when a back shop or two are eliminated in favor of the concentration of repairs in larger, more modern shops, to what extent are men, added at the shops taking over the added burden?

To attempt to answer the above questions in a manner which would appear favorable to the advancement of the individual entering railroad mechanical service, I think you will agree, would be foolish. I can take a pencil and paper at any time and prove that the great saving in such concentrations is in wages and that supervision generally gets the cut along with the others. Again, we who are working for the railroads of this country today are not laboring under any false impression as to the extent to which such concentrations of forces would be carried with a consequent decrease in forces and supervision, could the managements of our railroads come to some effective agreement on mergers with the Interstate Commerce Commission.

It may be true that such incidents in the management of the railroads are evidences of an attempt at stabilization, but isn't it at least as obviously true that for every supervisor whose rating is thereby reduced the opportunity of all men of equal or lesser rank in the organization is made just so much less imminent? Does the frequent recurrence of such phrases as "position abolished," "resigned and position abolished" or "jurisdiction extended" augur an increased possibility of advancement to any of us?

Now, to continue the debunking which Mr. Howarth has intimated was necessary. The interest, romance or special appeal may to some extent be there; I would not argue that point. A man who intends to follow a career with a railroad should have a decent and live interest in his business, else he should not be in it or expect advancement therein. However, I can see no reason why we railroad men should be considered childish enough to suppose that the interest, romance, etc., can or should supplant the fundamental and all important subject of wages.

I note that, while the impression left by your editorial seems to be toward some belittlement of the financial aspects of the railroad career, you omit any discussion of some normal interest which must be to a large extent sacrificed by the average educated man who may choose railroad mechanical service if he expects to attain any promotion whatever. Such interests as one's family or home life, social and spiritual life have a definite place in the well-rounded life of any man.

It must be remembered that the appeal and romance of railroad work does not extend appreciably into the lives of his family. A railroad man owes as much care and devotion to his family and as much of the advantages accruing from the possession of a normal reward for his labors as the man in any other industry.

Does he fulfill this obligation? I do not think so. In the first place, for many years in a large number of cases he knows no eight-hour day. He may work years at night. He may be expected to spend many of the best years of his life working ten to twelve hours a day, every second Sunday included, and on occasion he may be required to work much longer hours, irregularly, best years of his life working ten to twelve hours a chinery goes haywire.

In the meantime, can he find time to attend church, to impress on his children by actual example the value of religious training? Can he find time to be a real pal to them? Can he find time to instruct them and correct them and know them?

I have advanced as far as has any man with equal opportunity in our organization. Relatively, therefore, I should feel satisfied. However, I look forward with some eagerness and considerable impatience to the day

when I will be in a position to do something besides go to work, come home, eat and sleep. I look forward to broader and more intimate associations with the interests of my family. Also (how mercenary-minded I am!) I could use an increase in salary along with the rest. My friends outside the railroad—intimates who I believe are no better than I—are enjoying the advantages which only a possible future can bring to me.

A railroad man has responsibilities beyond himself and his railroad, and the man entering railroad service must weigh this fact well. He must be prepared, if he enters railroad service, to accept heavy limitations on his ability to discharge these other responsibilities.

ROUNDHOUSE.

The Auxiliary Locomotive Tests

GALVESTON, TEXAS.

TO THE EDITOR:

Readers who are disposed to study carefully the article on page 23 of your January number will not find it a very convincing argument for the auxiliary locomotive. Even though it be admitted that the tests reported are not sufficiently numerous to prove anything conclusively, enough information is presented to create doubt as to whether those who advocate the installation of miniature locomotives under tenders are headed in the right direction.

Let it be noted, first, that a series comprising two tests with heater-fed and one with injector-fed locomotives is not entirely comparable with another series made up of only one test of each kind. Comparisons of fuel consumption from averages derived in this way are slightly unfair to the second group of tests.

In the summary on page 24, one cannot help remarking the absence of any figures denoting the coal consumption per drawbar horsepower hour, or any reference whatever to the water consumed. Since these were dynamometer tests, such figures were undoubtedly compiled, and it may be presumed that they were omitted inadvertently. Those who wish a clear picture of the relative efficiency of the auxiliary locomotive will find it on page 622 of the November, 1928, *Railway Mechanical Engineer*, where the following statement appears: "The auxiliary locomotive adds to the drawbar pull, but does so at a lowered efficiency of the whole unit."

The chart, Fig. 5, on page 623 of the same issue, shows steam rates of from 32 to 54 lb. per hp. at the wheel rims of the auxiliary locomotive. When it becomes necessary to produce this extra steam by forcing the boiler with the blower (a not unknown procedure), the effect on fuel performance is not encouraging from the standpoint of the railroad.

In the eastbound tests on the Boston & Maine, an increase of 14.5 per cent in gross ton-mileage was accompanied by a similar increase of 14.2 per cent in coal consumed per trip, and a decrease of 7.9 per cent in average running speed. On the rising gradients between Mechanicsville and Eagle Bridge, the engine with the auxiliary locomotive required 24 per cent more time than the engine without this device, indicating the inability of the boiler to supply sufficient steam to move the extra tonnage up-grade at the speed customarily observed by regular trains. A 17.2 per cent increase in tonnage per train, offset by a 24 per cent increase in running time on ascending gradients, would not add to the capacity of a single-track railway. Of course, it is possible to make up part of the deficiency in speed by attaining higher velocities on descending grades, as seems to have been done in this case.

It is rather fortunate that westbound traffic on the Berkshire Division is considered of minor importance as the performance of the auxiliary locomotive in this direction was particularly unfavorable. It hauled 15.2 per cent greater tonnage (in cars of 16 per cent greater average weight), at the expense of 16.4 per cent increase in fuel consumption and a decrease of 12.1 per cent in average running speed. The increase of 37 min., or 83 per cent, in average duration of detentions while running in this direction should be explained.

A comparison of the eastbound and westbound performances of the auxiliary locomotive leaves the impression that the economic value of this appliance decreases as the steepness of the ruling grades increases, even though these grades are of moderate length. If we desire a general return to the slow-speed, heavy drag method of freight train operation, the indiscriminate use of steam-driven tenders is an excellent means of achieving that end.

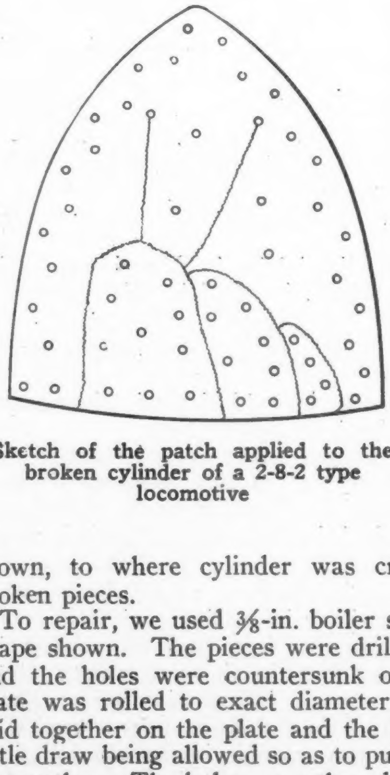
WM. T. HOECKER.

Welding Locomotive Cylinders

LORAIN, OHIO.

TO THE EDITOR:

The article submitted by E. P. Fairchild in the February issue pertaining to the repair of broken cylinders was especially interesting owing to the complicated nature of the fractures. The following description of repairs made to a 26-in. by 32-in. cylinder on a superheated 2-8-2 type locomotive may be of interest to your readers. Referring to the sketch of the patch, three pieces were broken out at the bottom front of the cylinder, and the cracks extended back, as shown, to where cylinder was cracked beyond the broken pieces.



Sketch of the patch applied to the broken cylinder of a 2-8-2 type locomotive

To repair, we used ⅜-in. boiler steel, laid off to the shape shown. The pieces were drilled for ¾-in. rivets and the holes were countersunk on the inside. The plate was rolled to exact diameter. The pieces were laid together on the plate and the holes marked off, a little draw being allowed so as to pull the sections tightly together. The holes were then drilled and the pieces were riveted to the plate. The formation of the fractures made it easy to apply to the cylinder. A small jack was used to bring all the parts into proper alinement and to hold the plate in position. The remaining holes were then drilled through and countersunk for rivets and the cylinder was rebored for the bushing.

The service rendered by this cylinder was satisfactory. Items for labor were as follows:

1 Boiler maker, 40 hours, at 75 cents an hour	$30
1 Helper, 40 hours, at 50 cents an hour	20
1 Drill operator, 2 hours, at 50 cents an hour	1
Total cost, exclusive of material	$51

JOSEPH SMITH.

Auxiliary Locomotive Tests

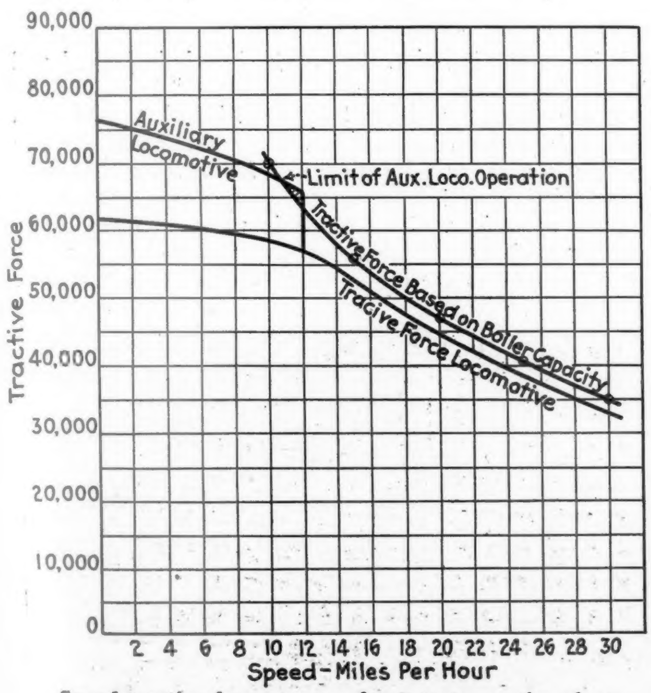
NEW YORK.

TO THE EDITOR:

Wm. T. Hoecker raises the question as to the advisability of equipping locomotives with tender boosters or auxiliary locomotives, and comments on the results of tests which appeared in an article in the January issue. It is unfortunate, for reasons outside of the scope of the subject under consideration, that the complication of injector and feedwater heater operation was brought into a series of tonnage-operation dynamometer tests.

Tonnage, eastbound, which was the governing and important movement, was increased from 2,957 to 3,467 tons, an average of 17.25 per cent, and with an increase in gross ton-miles per train hour from 55,718 to 60,188 or an increase of 8 per cent.

This means a reduction of one train for every six runs, resulting in less locomotive investment and maintenance, increase in the capacity of the line, with

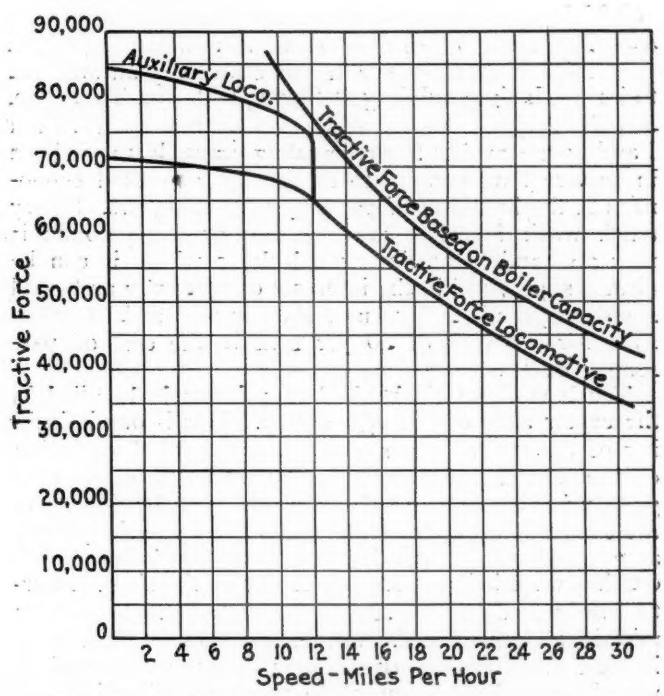


Speed-tractive-force curves from tests on the plant at Altoona

a negligible increase in running time and an increase in coal consumption of 14.2 per cent. This shows a slight economy despite the fact that the locomotive must be worked harder to handle this extra tonnage.

The extra time on the rising gradients between Mechanicsville, N. Y., and Eagle Bridge was not due to any deficiency in the engine's steaming ability, but to the fact that the locomotive was loaded more heavily, and was unable to handle the train at as high a speed as the lighter tonnage handled without the auxiliary locomotive. The auxiliary locomotive was used only when and if needed to handle the train or accelerate it. There was at no time any difficulty experienced with the locomotive from a steaming standpoint, as evidenced by the log shown on Page 24 of the January, 1930, *Railway Mechanical Engineer.*

The delays in westbound operation were not occasioned through any effect of the auxiliary locomotive, but by the usual exigencies of railroad operation. Considerable time was frequently lost both eastbound and westbound at the tunnel portal due to conditions imposed by electric locomotive operation in the five-mile Hoosac tunnel, which has since been eliminated by re-



Speed-tractive-force curves obtained from the road tests on the Boston & Maine

moval of the maximum power demand restriction. Trip No. 3 was noteworthy from the standpoint of two break-in-twos during brake applications for cutting off the electric locomotive and later entering a passing siding, due to a "kicker" near the end of the train.

Pusher operation is considered good practice where train loads over an operating division can be better adjusted to locomotive capacity by the use of helper locomotives on the ruling grades. If this is good practice where ruling grades sharply differ from average division conditions, it follows as good railroading, if a pusher engine is not justified, to employ an integral "helper" locomotive where the conditions warrant, thus more fully utilizing the main locomotive capacity.

Auxiliary power is not a universal panacea, but it has its utility. The facts presented in the paper were intended as an aid to the mechanical and operating officers in availing themselves of this self-contained "pusher" locomotive. No facts were concealed or "inadvertently omitted." These were tonnage-operation tests and not engine efficiency tests, and the table contains all the facts developed. The addition of a graphic picture of train requirements tied up with a definite profile, should demonstrate unusual features of marked value in developing locomotive requirements. Unfortunately, only 20 miles of the 85-mile division could be shown in the *Railway Mechanical Engineer,* but the complete picture for eastbound and westbound operation was developed and is published in the proceedings of the American Society of Mechanical Engineers.

GEO. W. ARMSTRONG.

With the

Car Foremen and Inspectors

Frisco Passenger-Truck Shop

SLIGHTLY over a year ago the St. Louis-San Francisco completed a new and well-equipped passenger-truck shop, which was essentially an addition to its coach-shop building at Springfield, Mo. This shop, 304 ft. long by 44 ft. wide and served by a 10-ton Pauling & Harnischfeger traveling crane, has now been in service long enough to demonstrate marked economies in the handling of passenger-truck repairs. Heavy truck work formerly done at two or three points is now all handled at Springfield shops where it can be closely supervised in the interests of efficiency and good standard practice. The new shop is said to be responsible for a saving of 30 per cent in the cost of passenger-truck repairs.

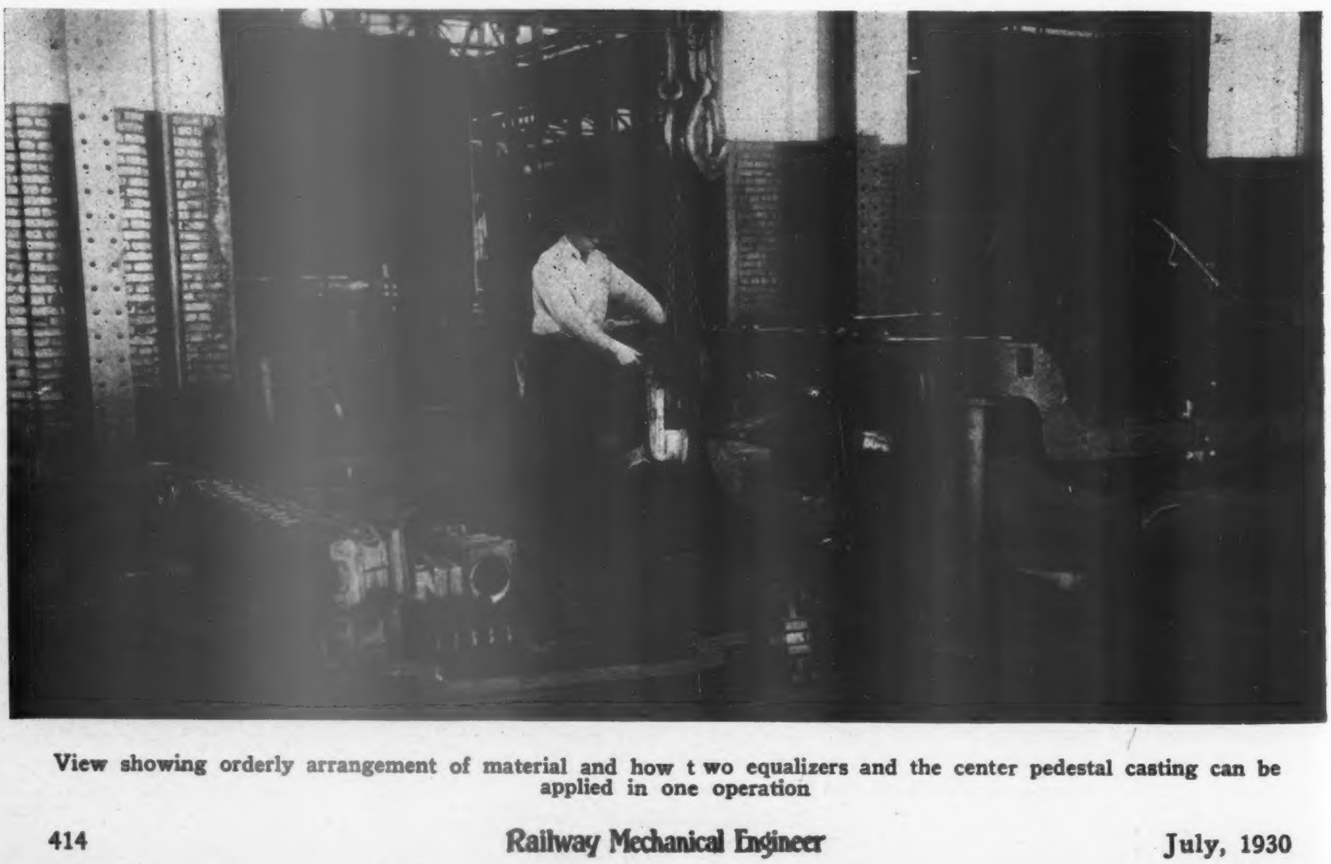
Truck work at Springfield was formerly handled in the center aisle of the coach shop. Hand- or air-jacking of the truck frames was required, and the location of the wheels and frames in the center aisle not only greatly handicapped coach-shop operation by adding to the congestion, but the truck work itself was frequently at a standstill for considerable periods of time while coaches were being moved in or out of the shop. Four- to five-hour delays were not infrequent; material was mislaid and misplaced. So, in addition to the saving in the cost of truck work, the new shop must be credited with increased efficiency in the coach shop itself.

The new shop has 20 truck positions, each of which is provided with trestle posts which can be depressed flush with the floor when not in use. These trestles are made of 5-in. and 5½-in. superheater flues, which telescope. The inner section is provided with a cast-iron cap on the top and the outer section rests on a base casting set in concrete. Each trestle has a 36-in. lift and is held in the raised position by means of a 1¼-in. steel pin through a hole in the inner flue and bearing on a slot in the outer one. The principal advantages of this trestle are that it is safe, takes little floor space, and, when not in use, can be lowered into the floor out of the way. Four of the truck stations are provided with six instead of four trestles each, the spacing being reduced three feet to accommodate the shorter four-wheel trucks.

Other equipment in the truck shop includes an 18-in. air-cylinder bushing press, two vertical drill presses and a large pneumatic drill mounted on a carriage and capable of horizontal movement over long side-sill plates. A small steam hammer is also installed in the truck shop, as well as a blacksmith forge for use in repairing equalizers, hangers, etc. Joyce air jacks are used for jacking the cars when removing the trucks.

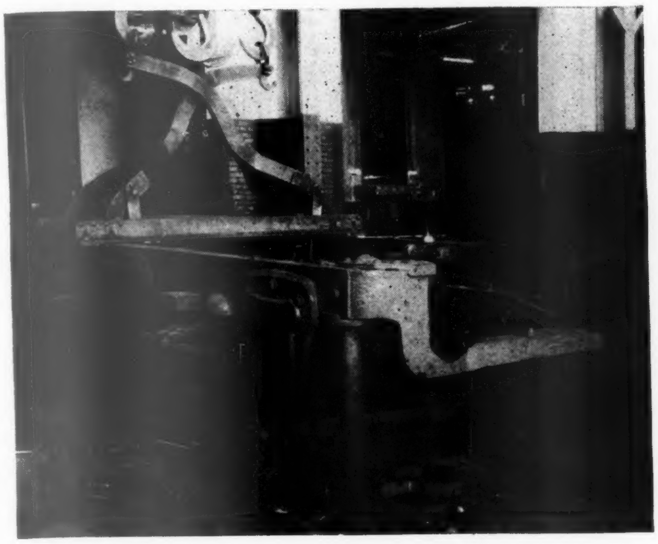
Method of Operation

When a car is set in the coach shop it is jacked and the trucks removed and taken to the sand house, where they are carefully cleaned by sand-blasting, and then returned to the truck shop. They are lifted by the crane which, it will be observed from the illustration, is provided with hooks of unusually large size in the interest of safety. The truck is moved to any open position with the trestles down. The pedestal straps are unbolted and the crane used to lift the truck frame.



View showing orderly arrangement of material and how two equalizers and the center pedestal casting can be applied in one operation

Journal boxes are removed and the wheels rolled out of the way. Trestles are raised and pins applied to hold them at the required height, the truck frame then being lowered onto the trestles. The crane is used to remove the truck bolster, the special spring clamp illustrated being employed in the removal of the elliptic springs.

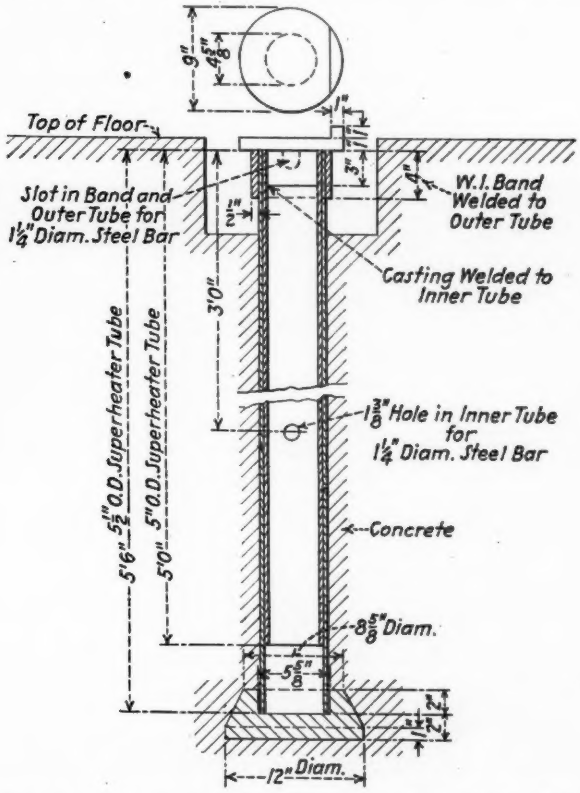


The spring clamp in operation with elliptic springs compressed ready for the application of the hangers and the pins

The spring clamp is a highly effective time-saving device. It is made of heavy material of such a design that upward movement of the crane hooks and ends of the lifting arms brings an upward pressure on the spring plank on both sides of the truck and compresses the elliptic springs, permitting the removal of pins and hangers.

One of the illustrations shows the truck used in handling heavy bolsters, spring planks, equalizers, etc. Close examination of the illustration will show two offset steel levers, which may be turned to an upright position on the beam of the truck and the recesses in the upper end made to engage diaphragm plates for ready movement about the shop. These plates are ordinarily awkward to handle and the truck illustrated contributes much to the safety and ease of handling these parts.

The next operation in stripping the truck is the removal of pedestals and equalizers. The worn jaws of the pedestals are built up by bronze welding, and the equalizers are repaired at the blacksmith fire. Journal



Details of truck-frame support which sinks flush with the floor when not in use

General view of Springfield passenger-truck shop

boxes are cleaned and the waste removed. The boxes are then inspected and left at the repair station. Necessary repairs are made to the truck bolster and spring planks; also to the truck frame, brake beams, etc. Wooden truck frames are rebolted and steel frames reriveted. Chafing plates on the truck bolster or truck frame are removed and new ones applied, this being done after everything is dismantled.

In reassembling, the spring clamp is used in the following manner: Special wooden trestles, 14 in. high, are placed one under each end of the spring plank, the elliptic springs then being placed on the spring plank and the truck bolster on top. The spring clamp

Wheel track in the passenger-truck shop—The spring clamp is suspended from the shop crane

is then applied to the truck with the arms extending one under each side of each end of the spring plank, operation of the crane then compressing the springs and permitting application of the mantel pins through the hangers.

One of the illustrations shows the orderly arrangement of material in the truck shop, and the method of applying equalizers and the center pedestal casting in one operation. With the use of the crane and the special hooks illustrated, one man can readily perform this somewhat awkward operation with ease.

The truck shop organization at Springfield includes one foreman, one assistant and eight gangs of two men each who take care of all truck and platform work. There are two brake-rod men, three drill-press operators, one blacksmith and one helper, two material supply men, one box packer and two jacking men, making a total of 21 men, including the supervisors. The output is approximately one heavy-repair coach a day. All coaches received at Springfield shops, however, have their trucks inspected and repaired irrespective of how much or how little work is done on the car body. The truck gang also handles all work of applying draft gears, safety chains, brake rods, buffers, etc.

An eastern railroad that has recently inaugurated a new limited passenger train effectively squelches one source of jokes for the perennial railway wag. In current descriptions of the new train is the terse announcement that the cars are furnished with windows "that will open."

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Car Rejected in Interchange—Revenue Billing Not Furnished

On February 6, 1927, car NYDX 976 broke in two while being handled in the Florida East Coast train No. 343. The owners were advised of this damage and after papers had been furnished them in accordance with A.R.A. Rule 120, the handling line received authority to place the car in condition to move home at a cost not to exceed $150. This work was completed and the car offered to the Atlantic Coast Line at Jacksonville, Fla., in homeward movement, the road which handled the car when it traveled southward under load. The A.C.L. refused to accept the car unless revenue billing was furnished. The question at issue was whether or not this car should be handled in accordance with A.R.A. Rule No. 2, or if it could be returned to the owners over the A.C.L., the Richmond, Fredericksburg & Potomac and the Baltimore & Ohio, each road handling the car without charge. In view of the fact that Rule 120 was involved, it was the opinion of the Florida East Coast that revenue billing was not necessary since rough freight could have been shipped in the car. The empty car was offered to the A.C.L. on May 6, 1927, at which time it was refused on account of its damaged condition which the A.C.L. maintained rendered it unsafe for loading. The car did not bear a defect card, it being the claim of the Florida East Coast that the damage occurred in fair usage. The A.C.L. maintained that the condition of the car was such that rough freight could not be loaded in it, stating that two metal sills were broken, and other sills badly damaged so that the car was not safe for handling empty unless placed next to the caboose and hauled carefully in the train.

In rendering a decision, the Arbitration Committee stated that "It is admitted, in the agreed statement of facts, that the Atlantic Coast Line was willing to accept this empty refrigerator car, for northbound movement over its line (in the direction of home shop) under revenue billing, which in itself is evidence that the Atlantic Coast Line did not consider the care unsafe for such movement. The evidence presented that the car was unsuitable for any commodity is not convincing that it was unsuitable for the loading of some commodity. Under these circumstances it is the opinion of your Committee that the Atlantic Coast Line was not justified in rejecting this car under Interchange Rule 2". *Case 1632—Florida East Coast versus Atlantic Coast Line.*

Wheels Skidded to Repair-Track and Slid Flat

Cleveland, Cincinnati, Chicago & St. Louis car 41674 was set out of a train on the Baltimore & Ohio on account of one cast-iron wheel having a broken flange. The B. & O. clamped this pair of wheels and moved

the car to its Fairmount shop, skidding the wheels. Here the wheels were changed and the owners billed for two new 33-in. cast-iron wheels, two new 10-in. journal bearings and 5.8 hours labor, less one 33-in. slid-flat wheel and one 33-in. wheel with a broken flange, at a net charge of $31.55. The car owner requested cancellation of the entire charge on the basis of A.R.A. Rule 68 and the principle set forth in Arbitration Decisions 988 and 1564. The owner contended that Rule 68 provided for no circumstance or condition creating slid-flat wheels, whereby that responsibility may be transferred to the car owner. The B. & O. declined to cancel the charge contending that the broken flange was the owner's defect and the slid-flat mate wheel was additional unavoidable damage resulting from the movement of the car to the shop to make repairs. The B. & O. further contended that this action was in line with Rule 32, paragraph (e) and Arbitration Case 1554.

The Arbitration Committee rendered the following decision: "Responsibility of car owner is confined to wheel with broken flange. Responsibility of handling line for mate wheel, slid-flat, includes the entire labor R. & R. as well as journal bearings, etc."—*Case No. 1633—Cleveland, Cincinnati, Chicago & St. Louis vs. Baltimore & Ohio.*

Responsibility for Cars Damaged by Emergency Application of Brakes

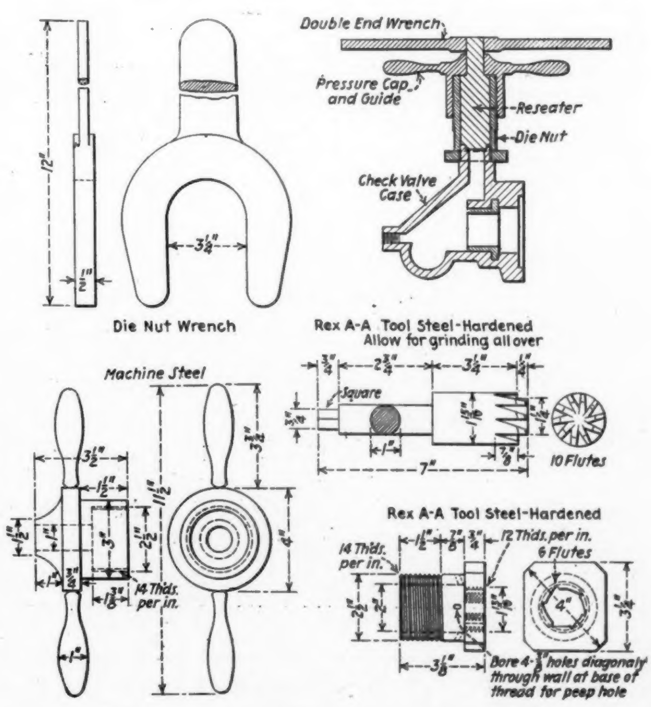
At Spartanburg, S. C., on February 8, 1929, a train of 22 empty and 36 loaded cars parted between the Southern engine 1883 and the first car, while the Charleston & West Carolina engine 175 was pushing the train. This caused an emergency application of the brakes which resulted in damage to two side sills, two center sills, two intermediate sills, one end sill, two corner posts, two sill stiffeners, one metal body bolster, one cross-tie timber, one Bradford coupler yoke, two Bradford draft castings, one side plate, two roof columns and four truss rods, on C. & W. C. all-wood box car 1148 which was the twenty-sixth car from engine 1883. Carolina, Clinchfield and Ohio car 41428, which was the twenty-seventh car from engine 1883 was also slightly damaged. The handling line issued its defect card for the damage to C. C. & O. car 41428 and reported C. & W. C. car 1148 under Rule 120. The Southern stated that the C. C. & O. car was telescoped by the C. & W. C. car and that no damage was done to the latter above the floor line with the exception of several of the end-sheathing boards which were pulled down by the breaking and dropping of the end sill and longitudinal sills. The Southern maintained that the C. & W. C. car failed in fair service and that there was no evidence of unfair usage under Rule 32 and that the decisions in Arbitration cases 1388, 1471 and 1561 were applicable as to telescoping and that decisions in cases 1261, 1431, 1570 and 1573 were applicable as to the result of the emergency application of the brakes caused by the parting of the train. The C. & W. C. declined to accept responsibility for the damage to its car, claiming that it was telescoped. The parting of the train was caused by a low front bumper coupler on the Southern engine 1883 which, the C. & W. C. contended, placed the responsibility for the damaged car on the Southern since it should have been known that the coupler was too low. The owner further contended that the handling line should accept full responsibility for cars damaged while being handled with defective equipment.

The decision as rendered by the Arbitration Committee is as follows: "The position of the Charleston & Western Carolina is not sustained. Owner is responsible for failure of C. & W. C. car 1148, per Decisions 1261 and 1431. Handling line is responsible for damage to C. C. & O. car 41428, due to it having been telescoped by former car, per Decisions 1388 and 1471."—*Case 1635—Southern vs. Charleston & Western Carolina.*

Repairing Triple-Valve Check-Valve Cases

WHEN the union nut connection at the check-valve case of a triple valve is chipped or a small section of it is broken as a result of careless handling when removing it from the car or when handling in the stock room it will often be scrapped if the counterbore for the rubber gasket is filed or ground away while repairing it. To avoid scrapping the check-valve cases on this account, the tool shown in the illustration was designed. It serves to face the union-nut connection, to counterbore it and to clean or extend the threads.

The tool consists of a hardened tool-steel six-flute



The tool used for rethreading, reboring and facing the union connections of check-valve cases

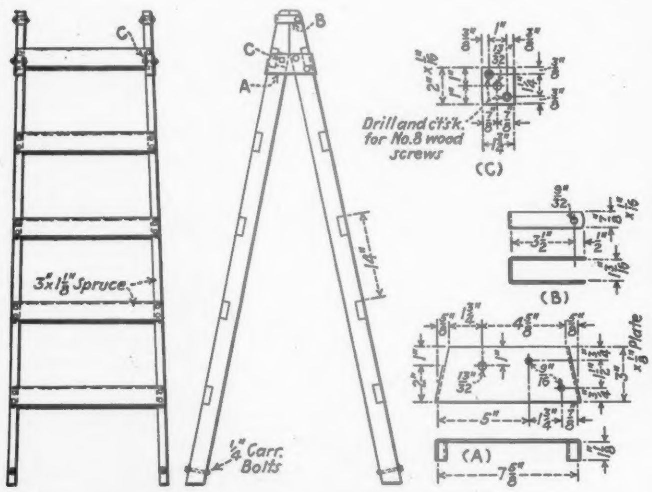
die nut the diagonal width of which is 4 in. and the length of which is 3⅛ in. The die nut is machined round for a length of 2⅜ in. and is threaded for a distance of 1½ in. A 10-flute reseating tool for counterboring and threading the union connection fits in the die nut which is bored to a diameter of 2 in. The reseating tool is held in place, guided and advanced in the counterbore by a pressure cap which is threaded

to fit the die nut. The overall width of the handles of this cap is 11½ in.

When in use the die nut is run over the threads of the check-valve case after it has been filed or ground down below the broken or chipped portion. The die nut can be used merely to clean the threads of the union connection or to run additional threads if needed. After the threads have been repaired the reseating tool is inserted in the bore of the die nut and the pressure cap threaded to the top section of the die nut. The pressure cap is screwed down as needed to counterbore and face the union connection. The reseating tool is manipulated by a double-end wrench which fits the top of the reseating tool which is machined ¾ in. square for this purpose.

Safety Ladder for the Carman

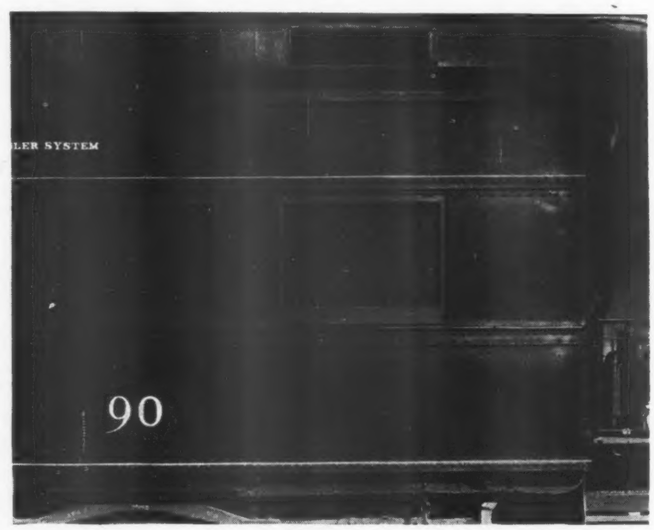
SHOWN in the drawing is a safety ladder which was designed by coach repairman Volney Harrington of the Colonie, N. Y., car shops, of the Delaware & Hudson. This ladder was designed in response to a demand for a more stable arrangement than those previously used at that point. The clip *B* at the extreme top of the ladder prevents the closing of the legs. This clip is pivoted on a ¼-in. bolt and can be thrown back out of the way when the legs of the ladder are closed. The lower band *A* is designed to prevent the legs from spreading. It is made of ⅛-in. plate and one leg of the ladder is pivoted to the plate by a ⅜-in. bolt. The ladder shown in the drawing is 6 ft. 5 in. high, but it can be made for different heights to suit the requirements of the shop.



Safety ladder used at the Colonie shops of the Delaware & Hudson

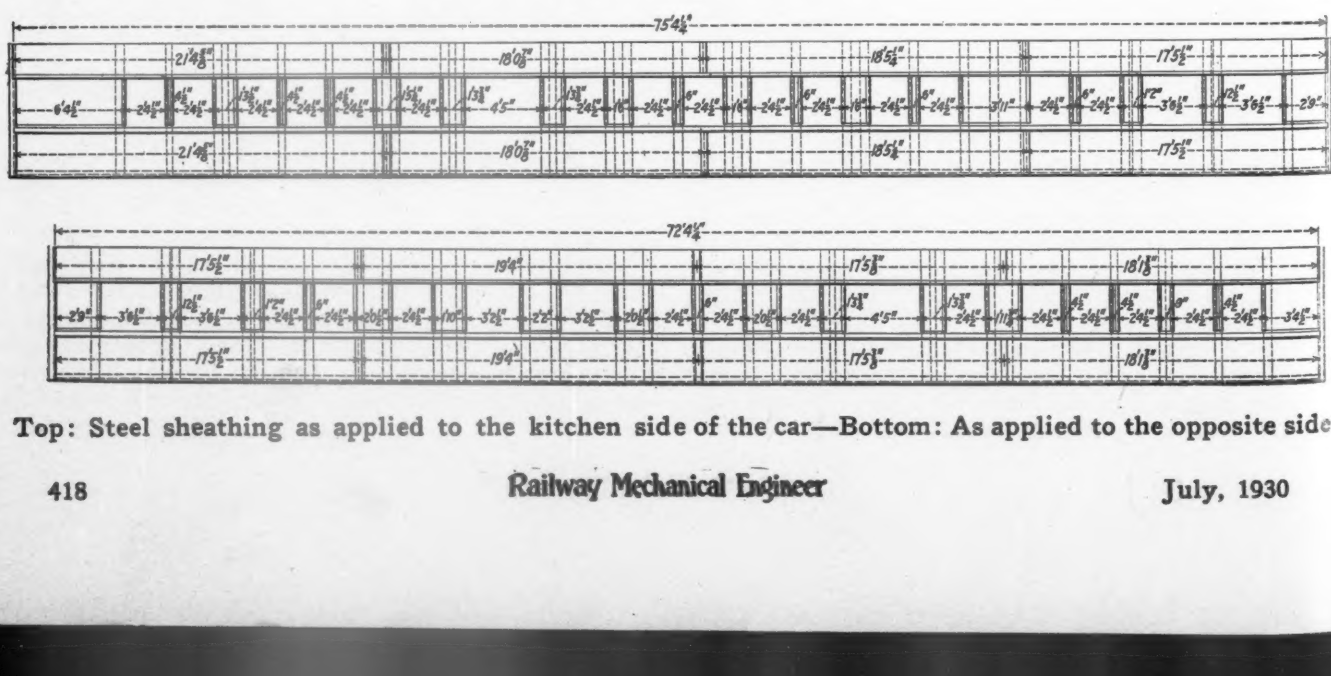
Steel-Sheathing Wood Passenger Cars

A NUMBER of roads have passenger cars of wood-body steel-underframe construction that must frequently be used in trains in which all the other cars are of all-steel construction. As a rule, such cars are for special services and, with the exception of the body structure, are of modern design and equipped to meet the needs of the specific purpose for which they were built. For reasons of safety and appearance, many of these cars are being sheathed with steel plate as they go through the coach shop for heavy repairs.

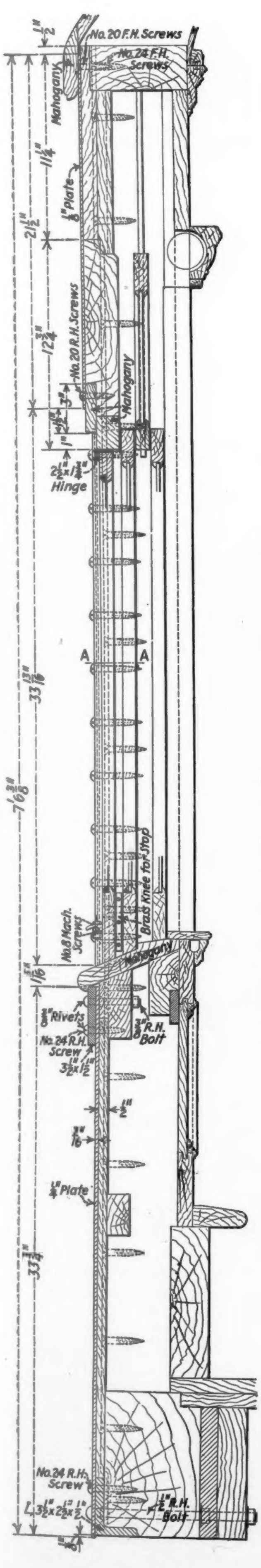


Round-head bolts and screws give the appearance of rivets

An example is that of the Florida East Coast business car which is shown in one of the illustrations.



Top: Steel sheathing as applied to the kitchen side of the car—Bottom: As applied to the opposite side



Application of the steel sheathing to the side of the car

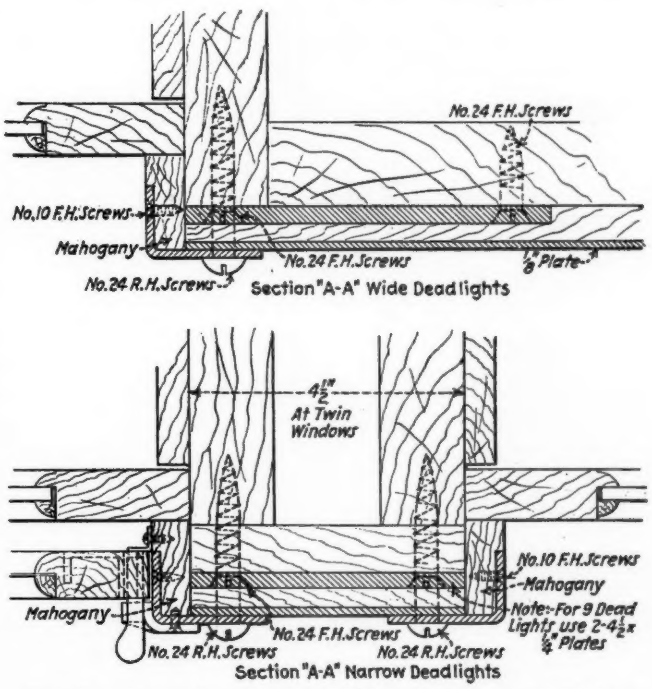
This car was sheathed with steel at the Miller coach shops, St. Augustine, Fla. It is of steel-underframe construction, with a vestibule at one end and an observation platform at the other. The over-all length of the car body, exclusive of the rear platform, is 75 ft. 4¼-in.

Four ¼-in. plates were used to sheath the wall underneath the windows, and plates, ⅛ in. in thickness, were applied above and between the windows. The corners at the ends of the car and at the window frame were lapped with ⅛-in. plate.

A 3½-in. by 2½-in. by ½-in. angle, which extends the length of the car, is secured to the side sill by means of ½-in. round-head bolts. Round-head bolts and screws were used in all places where the heads protruded from the side of the car. The notches in the screw heads were filled before the car was painted to give the appearance of rivet heads.

Additional strength at this point is also secured by the use of heavy wood framing and a stiffener plate along the inside wall. It will be noted that the lower edge of the bottom side plate extends ⅛-in. below the side sill which gives a finished appearance to the side of the car.

Sheathing the wide and narrow deadlights presented



Detail construction at the wide and narrow deadlights

a somewhat difficult problem. This was satisfactorily solved by using 4½-in. by ¼-in. plates to reinforce the frames between the windows, and ⅛-in. plates for the sheathing. The corner plates are lapped on the outside, as shown, and are recessed into the wood window frame at the inside.

Florida East Coast business car as it appears after being steel-sheathed

A 3½-in. by 1½-in. reinforcing plate is riveted to the top of the bottom plates. This plate extends the length of the car body directly underneath the windows and serves to strengthen the body structure of the car through the center.

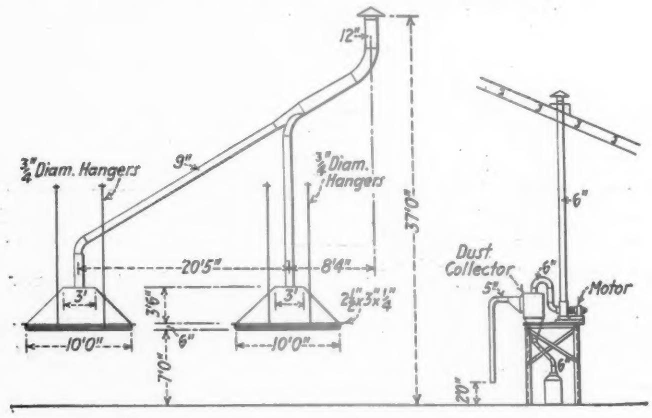
The kitchen side of the car is 3 ft. longer than the side opposite and the windows are spaced differently. This required seven different lengths of top and bottom side plates, only four plates being of the same length, 17 ft. 5½ in. The longest plates were 21 ft. 4⅝ in.

This car was finished in the same manner as an all-steel passenger car. It first received a coat of metal primer, which was followed with three coats of surfacer and rubbed down. The painting was completed with two coats of finish and three coats of varnish. All the paint applications were sprayed on.

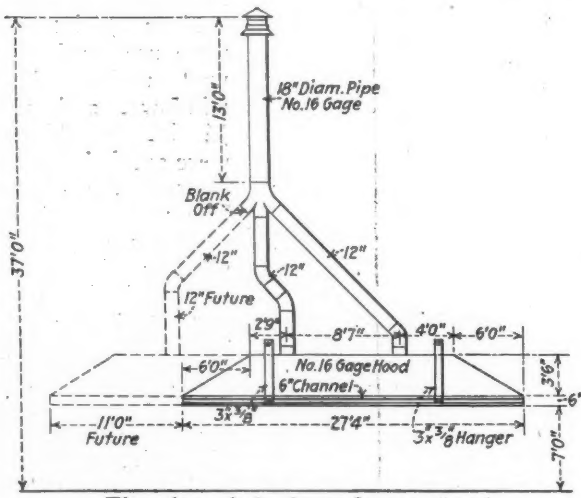
In the Back Shop and Enginehouse

A Well-Equipped Brass Foundry

THE Florida East Coast has a brass foundry at Miller shops, St. Augustine, Fla., which is well arranged and is completely equipped with benches, cranes, etc., that have been especially designed for the job. Crane service is provided through the center of the foundry, over the furnaces, mold stands, scrap lining furnace and tumblers. A 16-ft. jib crane, which has a capacity of 1,000 lb., serves a 2-ft. babbitt furnace and the adjacent area. Car journal bearings are molded on one side of the foundry while locomotive driving boxes and bearings are handled on the opposite side. An industrial track facilitates the handling of driving boxes and other heavy material to and from the shop.

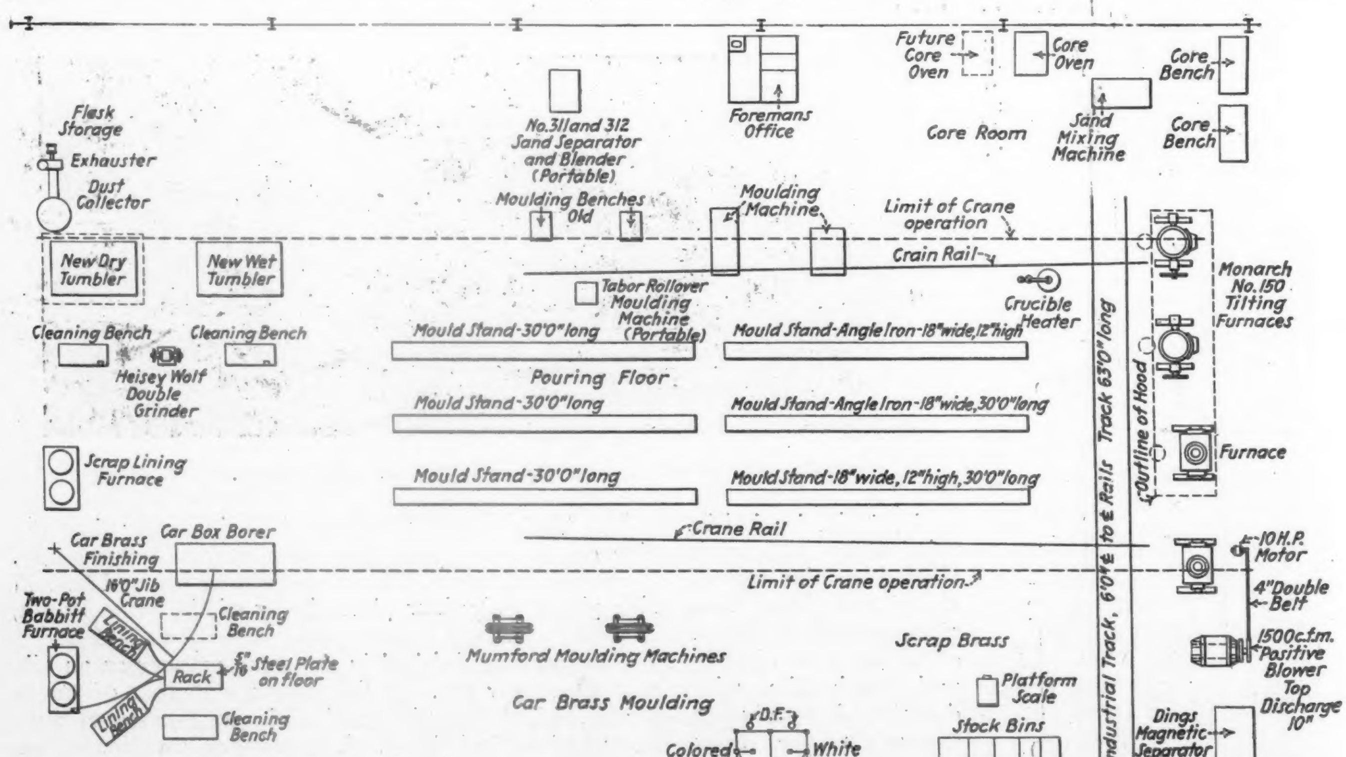


Elevation of the babbitt-furnace hoods



Elevation of the brass-furnace hoods

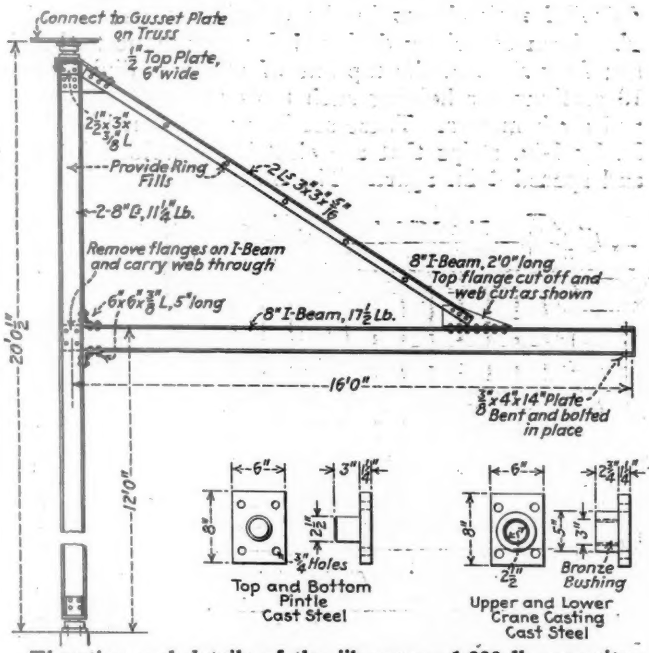
All the brass furnaces are located at one end of the foundry. Venting of the smoke and gases from these furnaces is secured by means of a hood, shown in one of the drawings. This hood is made of No. 16 gage steel and is braced with 6-in. channels around the edge. The hangers are made of 3-in. by 3/8-in. bar.



Layout of the brass foundry of the Florida East Coast at St. Augustine

Provision was made in the design of this hood for an additional length of 11 ft. and a third exhaust pipe. With the present installation, two 12-in. exhaust pipes carry the gases from the hood to an 18-in. pipe which extends up through the roof.

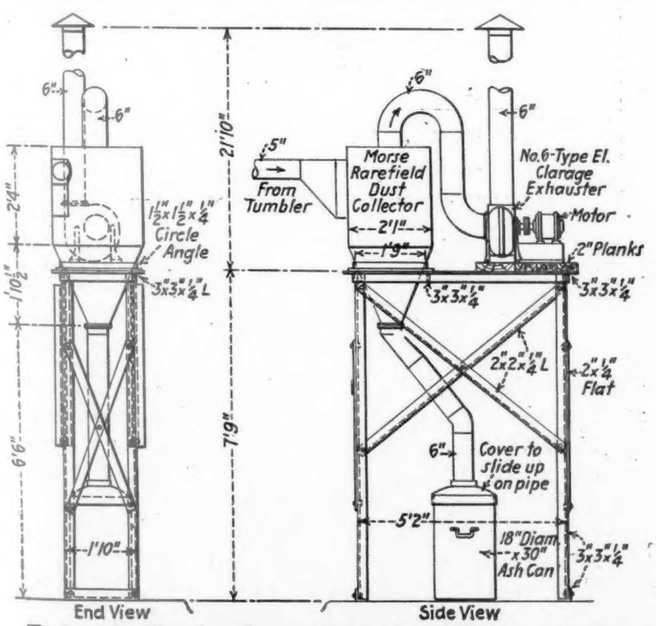
Separate hoods are provided for the babbitt and scrap lining furnaces. A 9-in. pipe carries the gases



Elevation and details of the jib crane—1,000 lb. capacity

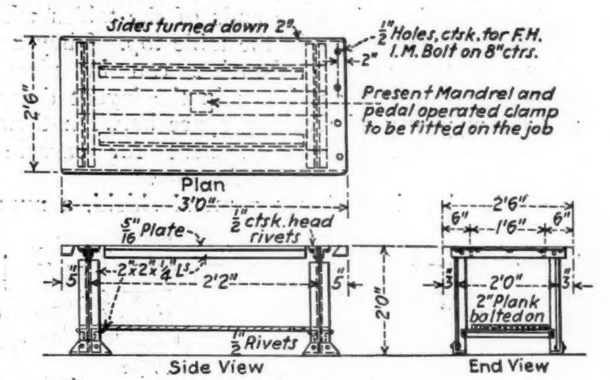
from the hoods to a 12-in. pipe, as shown in one of the drawings. This drawing also shows the location of the dust collector and exhaust pipe with respect to the hood arrangement over the babbitt furnaces.

The dust collector is located adjacent to the dry



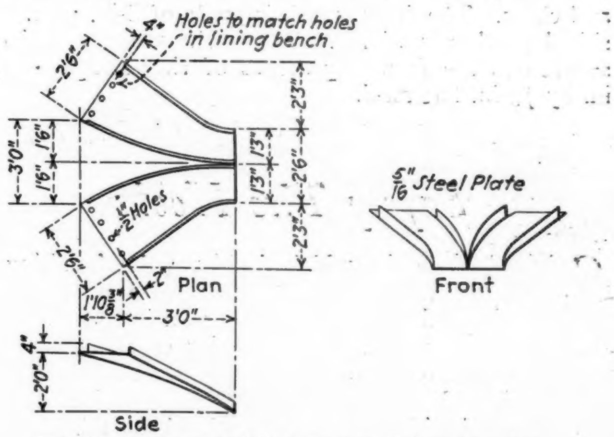
End and side elevations of the dust collector showing the piping from the tumbler

tumbler. A Morse-Rarefield dust collector, powered with a No. 6, type El Clarage exhauster with a motor drive, exhausts the dust from the dry tumbler. The dust is entrained in the collector from which it falls through a 6-in. pipe into a large ash can placed underneath the scaffold. The ash can is provided with a close fitting cover with a hole in the center which fits around the pipe. The cover can be raised by sliding it up on the pipe which facilitates removing or replacing the ash can.



Lining bench

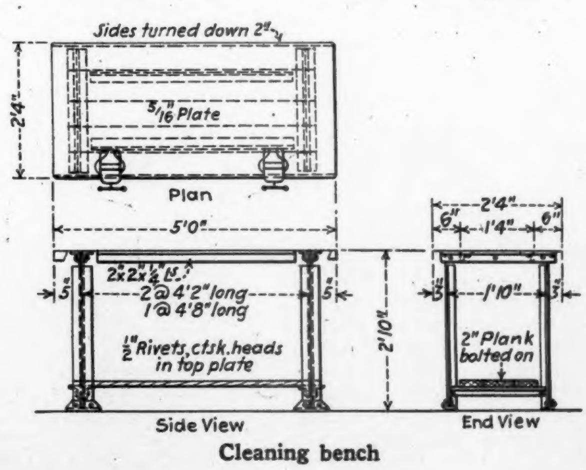
The cleaning benches used in the babbitt department are 2 ft. 10 in. high, and can be made from scrap steel-car materials. The top is covered with a 5/16-in. plate. A shelf of 2-in. plank is also provided underneath. The benches used for cleaning brasses are equipped with quick-acting type swivel-base vises. One of these vises is installed on the bench used for brass cleaning, while two vises are used on the benches for car brasses.



Detail of chutes applied to the lining benches

No vises are installed on the core-cleaning benches.

The lining benches are 2 ft. high and are somewhat similar in construction to the cleaning benches. A square hole for the mandrel is cut in the center of the table. The clamp on the mandrel is designed to be

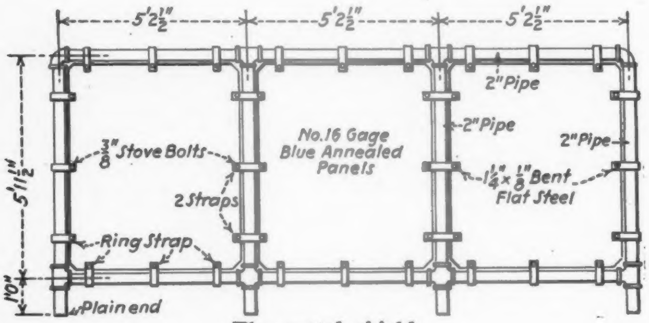


Cleaning bench

operated by a foot pedal which is located in a convenient position for the workman.

Chutes made of 5/16-in. steel plates carry the lined brasses from the lining benches to a rack, which is centrally located with respect to the two benches. These chutes are bolted to the ends of the tables with flat-head bolts, countersunk in the table top. They are shaped so that the lining benches can be placed obliquely to each other, as shown in the layout drawing, and allow plenty of working space between them. This arrangement is also convenient for carrying molten babbitt from the two-pot furnace.

One of the drawings shows a metal shield, a number of which are used in various locations in the foundry to protect the workmen from flying sparks and chips. The frame work is made of 2-in. pipe. The shield portion is of No. 16 gage sheet metal, which is secured to the frame by means of ring straps of 1¼-in. by ⅛-in. flat steel.



The metal shield

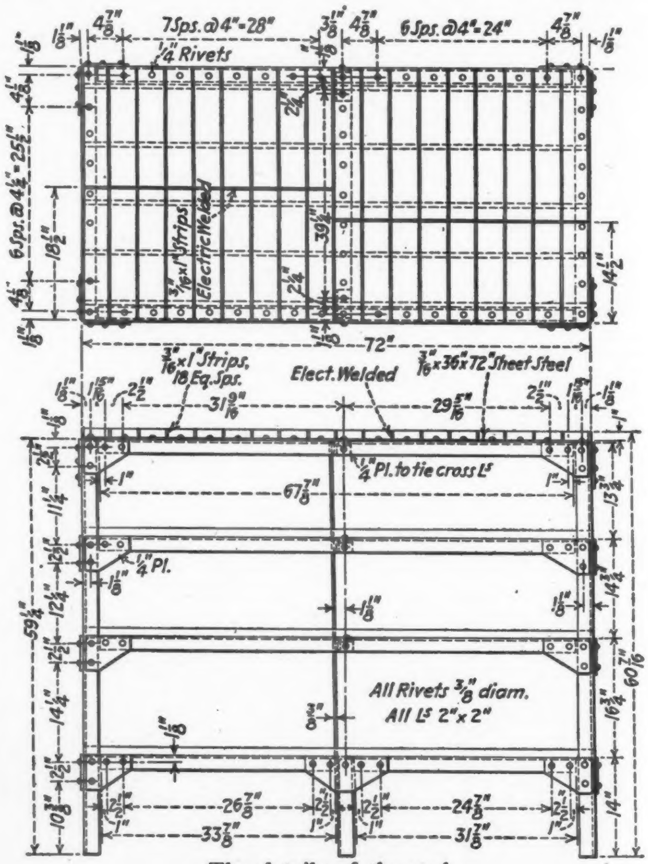
Safety Tire Hooks

SEVERAL hooks which facilitate the handling of tires and which do this work with a maximum amount of speed and safety are shown in the drawings. *A* shows a clamp which is used for carrying a tire in a vertical position by overhead cranes. The eye of this hook is riveted and welded to the clamp which is offset and equipped with a set screw to hold the tire securely in place and prevent it from slipping.

B illustrates a convenient lifting tongs for carrying tires in a vertical position. It is self locking since the lifting action of the crane tightens the tongs as they are being raised. These tongs are equipped with a safety lock which prevents the hooks from releasing the tire when the tire strikes the floor while being lowered. *C* shows a grab hook used for carrying tires in a horizontal position. The hook portion can be cut from ⅝-in. or ¾-in. boiler plate with an acetylene torch and bent to conform to the contour of the tire flange. *D* shows a similar grab hook also used for carrying tires in a horizontal position. The portion of this hook through which the chain passes has an offset lip that locks the tire in the hook as it is raised by the crane.

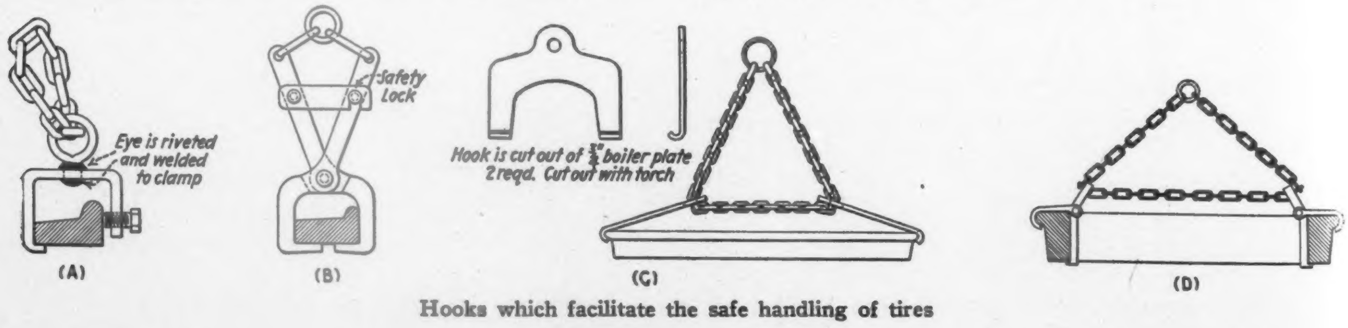
Pneumatic Tool Rack

THE rack shown in the drawing is one that has been especially designed for pneumatic tools. It has four shelves, the top one of which is divided into 13 sections for holding such tools as small air motors and air hammers. These sections are formed by 3/16-in. by 1-in. strips that are electrically welded in place and spaced 4 in. apart. The other shelves, which are



The details of the rack

used for the heavier pneumatic tools, have ½-in. by ¾-in. iron strips running the length of the rack that are also welded in place. The rack is 72 in. in overall length and is 60 7/16 in. high. The first shelf is 14 in. above the floor and the second, third and fourth shelves are spaced 16¾ in., 14¾ in., and 13¾ in., respectively. Sheet steel, 3/16 in. by 36 in. by 72 in., is used for the shelves, ⅜-in. rivets and 2-in. by 2-in. angle is used throughout in its construction.



Hooks which facilitate the safe handling of tires

Valve Setting at Paducah Shops

In order to get an accurate job of valve setting in less time than formerly, the valve-setting machine used at the Illinois Central shops at Paducah, Ky., moves the locomotive itself during the valve-setting operation instead of turning the main wheels on rolls as is perhaps the more common method. This valve-setting machine consists of a Westinghouse variable-speed, 25-hp. induction motor, mounted on a ¾-in. steel base plate which also carries the reduction gear, control equipment and the steel drum for winding and unwinding the 1-in. wire operating cable. Push-button control is provided by means of an eight-lead cable extension to a control switch mounted on a fiber board on one end of a pair of ⅛-in. by ¾-in. spring-steel strips, which are spaced 6 in. apart by means of suitable welded diagonal and spacer strips and may be hooked on the running board or carried by the valve setter as he moves along with the locomotive.

Valve Setting of Typical Illinois Central Locomotives

	Switcher	Mountain	Pacific
Travel	6¾ in.	8 in.	7 in.
Lead, forward	⅛ in.	1/16 in.	3/32 in.
Lead, backing up		17/32 in.	13/32 in.
Lap	1 in.	1 5/16 in.	1⅛ in.
Inside clearance	0 in.	⅛ in.	⅛ in.
Lead	Constant	Increases	Increases
Gear	Baker	Walschaert	Walschaert

This device was developed at Paducah shops, the motor being furnished by Westinghouse, the controller by the Industrial Controller Company, Milwaukee, Wis., and the reduction gear and general assembly of the power unit by the Morgan Engineering Company, Alliance, Ohio. Three lifting rods, joined in a ring above the machine, permit moving it about the shop readily by means of a crane.

When using the machine, it will be observed that two holes cut out in the foundation sheet fit over rail stops located at the inside end of each pit and hold the machine stationary when the cable is in tension. In operation, therefore, the valve setting machine is simply spotted over the inside end of the pit, with the rail stops projecting up through the holes cut out in the foundation sheet. The cable is attached by a hook directly to the locomotive or through a 10-in. single block, depending upon the direction in which movement is desired. Extremely fine adjustments of loco-

Another view showing the valve-setting machine anchored by means of rail stops projecting through holes in the base plate

General arrangement of valve-setting machine, including motor controller, reduction gear, slip gear and cable drum

motive position are obtainable with the machine alone, although to avoid any possibility of going by the center mark, tension is usually brought to bear on the locomotive through the cable and the last fine adjustment made by means of a pitch bar under the main wheels of the locomotive.

Method of Operation—Walschaert or Baker Gear

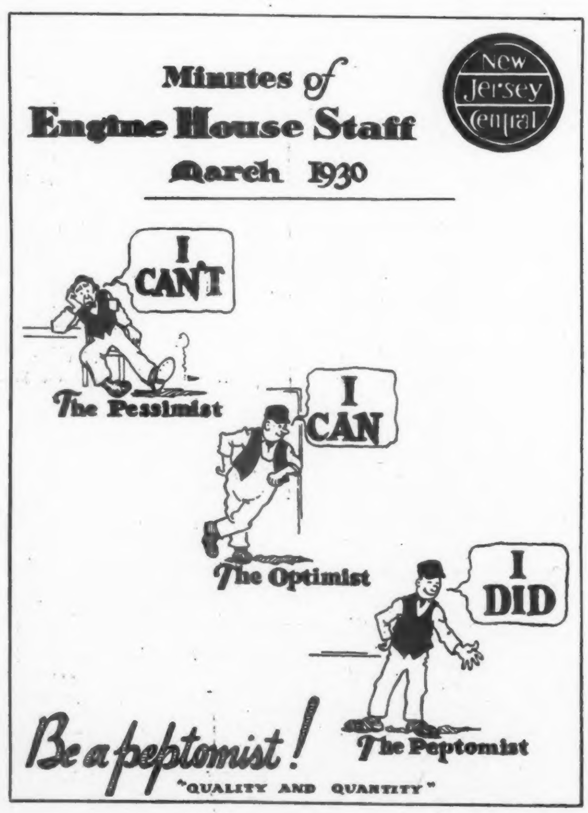
The valves of all classes of locomotives overhauled at Paducah shops are set with this machine, the settings for typical switcher, fast freight and passenger locomotives being shown in the table. All valve-gear parts are repaired and brought back to blue-print size, then being returned to the erecting shop. The locomotive is wheeled and pistons, valves, crossheads and rods applied. Valve-motion parts are tested for free movement; the links swung with the link blocks on center to make sure there is no valve movement, all parts connected up and the length of the reach rod adjusted to give full movement of the block in the link, from full forward to full back-up position. The position of each eccentric crank is determined by a keyway already machined in the crank pin in the correct position to give the specified throw of the eccentric. This throw is again checked, however, by means of the usual ball-type swing gage applied to the wheel center. Knowing from the fixed rod and wheel dimensions how much the crosshead must be back of its center position to bring the opposite crank pin on dead center, the right main wheel is quartered accurately with a tram from the frame, all four dead center points being obtained. The locomotive is slowly moved forward and the first dead center caught, a tram mark from a fixed point on the main valve stuffing box being scribed on the valve stem. Similarly the other four dead centers are marked. The locomotive is moved about 10 in. further ahead so as to give an opportunity to take up slack, the reverse lever then being pulled to the back-up position, the four centers again caught in the backward motion and the valve stems scribed for each position. This is all the movement of the locomotive which is required.

Powerful valve-setting machine developed and used at the Paducah shops of the Illinois Central—Note portable push-button control switch

The port marks are scribed on the valve stem and compared with the lead marks, necessary alterations being made to square the valves and give the desired lead, shown in the table. The required alteration in eccentric rod length is determined by the distance between the centers of the two forward- and the two back-motion marks, multiplied by the ratio of the eccentric rod throw to the valve travel. The radius-bar length is corrected on each side of the locomotive, as determined by the distance between the center of the lead marks and the center of the port marks. Valve events are not taken in the shop valve-setting operation with the reverse lever hooked up as experience has shown this feature must be checked in any event by running the valves over after the locomotive has been broken in in service operation.

The setting of valves by this method takes one mechanic, one apprentice and a helper about five minutes to quarter the main wheels before moving the locomotive, and eight minutes to get the travel marks in the forward and back motion. Only one movement forward and one back is required. The time formerly required for setting valves on the average locomotive was about eight hours with the same number of men. Aside from the saving of time, this method of valve setting has the additional advantage that it does not interfere with the application of rods and other finishing operations; it saves the labor and expense of putting up a main or dummy rod; and, in some respects, is more accurate than when main wheels are put on rolls, owing to the fact that the locomotive is down on its springs, usually with water in the boiler, and all parts more nearly in working order.

* * *



Cover used on the report of the proceedings of the March meeting of the enginehouse foremen of the Central Railroad of New Jersey

Skidding Device for the Wheel Press

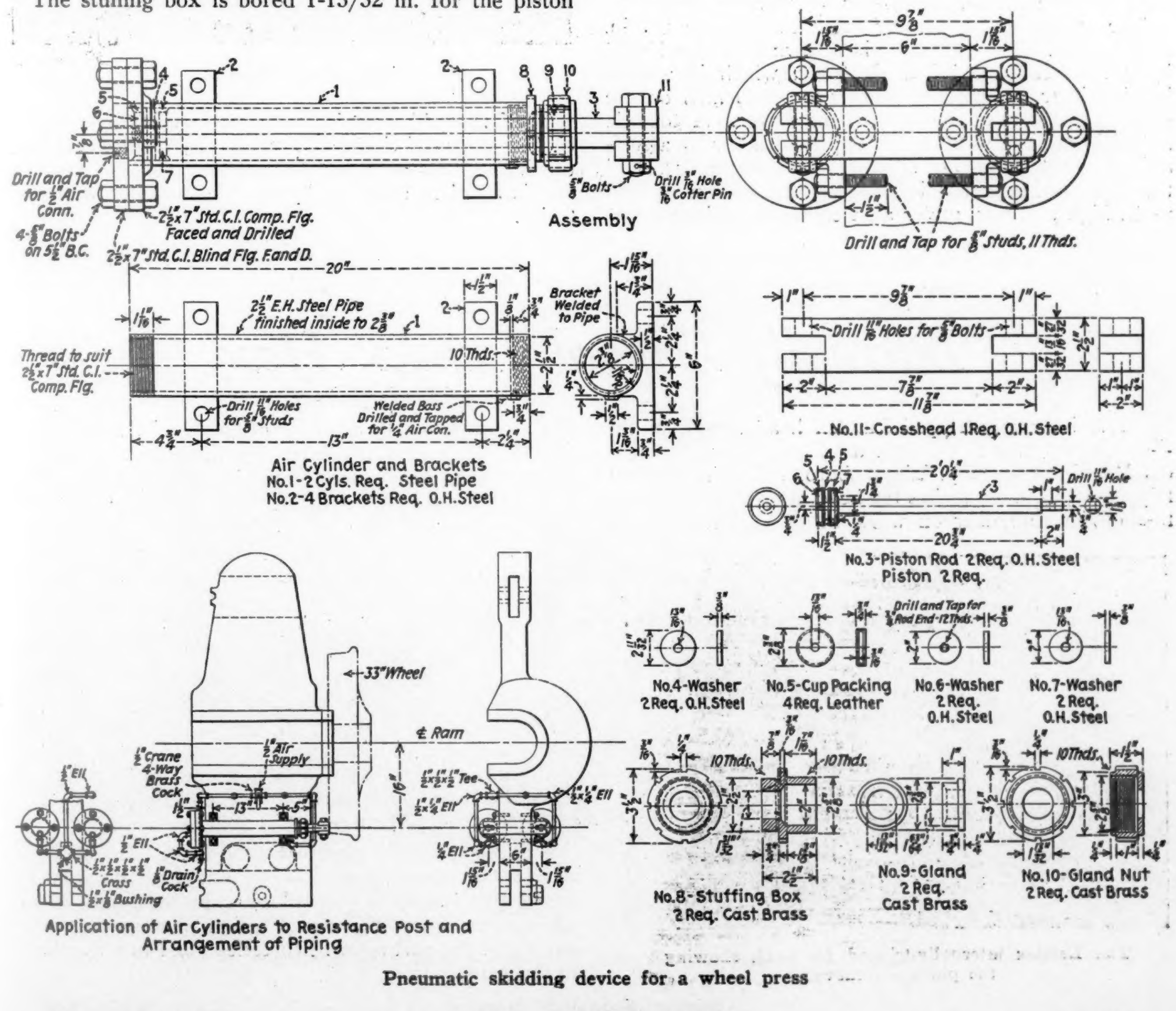
TO overcome the difficulties connected with skidding the resistance post of a wheel press by hand, the pneumatic device shown in the drawing was designed for use in the wheel shops of an eastern road. It is comprised of two cylinders set on each side of the resistance post and two pistons which, when thrust against the wheels in the press, will skid the resistance post to any desired position by the manipulation of an air control valve with which the device is equipped.

The compressed-air cylinders are 20-in. sections of 2½-in. O. H. steel pipe finished inside of 2⅜ in. Each cylinder is fitted with two ¾-in. by 6-in. brackets which are welded to the cylinders and drilled with 11/16-in. holes for ⅝-in. studs. These studs are used for bolting the cylinders to the resistance post. One end of each cylinder is threaded to suit a 2½-in. by 7-in. cast-iron flange to which is bolted a blind flange of the same size. The blind flange, which is faced to prevent air leakage, is bolted in position by means of four ⅝-in. bolts and is drilled and tapped for a ½-in. air connection. The other end of each cylinder has a welded boss, drilled and tapped for a ¼-in. air connection, and is fitted with a stuffing box, the parts of which are made from cast brass.

The stuffing box is bored 1-13/32 in. for the piston rod fit and 2 in. for the packing gland fit. It is 2½ in. in diameter on the cylinder side, 2⅝ in. in diameter on the packing-gland side, and 3½ in. in diameter at the outside of the stuffing box nut. The packing gland is 1 in. long and has an outside diameter of 2⅜ in. while the packing-gland nut is 1½ in. long and has an outside diameter of 3 in.

Each piston-rod of the device is 1⅜ in. in diameter, has an overall length of 24¼ in. and is machined at one end to a diameter of ¾ in. for a distance of 1½ in. The ¾-in. by 1½-in. end is fitted with two 3/16-in. packing leathers which are held rigid by three ⅜-in. by 2-in. O.H. steel washers securely bolted in place. The other end of the piston rod is machined flat to a thickness of ¾ in. for a distance of 2 in., this serving as a means for bolting the piston to the crosshead. The crosshead is 2 in. wide, 2½ in. thick and 9⅞ in. long and is slotted for a distance of 2 in. at each end, the slot being 13/16 in. wide. It is bolted to each piston rod by means of ⅝-in. bolts.

The assembly drawing of the device shows the piping arrangement. One valve controls the air supply to either end of both cylinders, thus simplifying the control of the device. When it is desired to skid the resistance post away from the ram, the piston is set against the wheels which are in the press and air is admitted behind the piston. The post can be skidded in the opposite direction by chaining the crosshead to the ram and admitting air in front of the piston.



Pneumatic skidding device for a wheel press

NEW DEVICES

The Clark Trucwelder

THE Clark Trucwelder, a self-contained, gas-powered, electric arc-welding unit, designed for use in places and on work where there is no convenient source of electric power, has recently been placed on the market by the Clark Tructractor Company, Battle Creek, Mich. The unit is equipped with a self-starter and headlights, carries General Electric standard welding accessories and has room for acetylene tanks, cutting equipment and seating room for a crew, besides power for towing trailers.

An arc-welding current, ranging from 60 to 250 amperes at 25 volts, is developed by a self-excited G. E. arc-welding generator with control, driven by a heavy-duty, four-cylinder gas engine developing 20 hp. at 1,480 r.p.m. Currents between 25 and 60 amperes may also be obtained by inserting in the circuit a current-reducing resistor provided for the purpose. The current available is ample for use with all commercial sizes of metallic electrodes from 1/16 in. to 3/16 in. and also for light carbon welding or cutting.

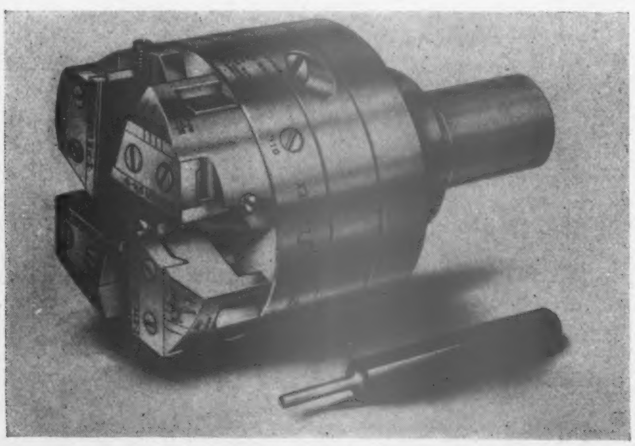
The engine and generator are connected by a 3-in. endless belt. The generator is thrown in and released by a hand-controlled belt tightener, which is a ball-bearing idler mounted on sliding ways, located on the driver's platform at the right of the driver. Automatic stabilizing of the welding arc is provided for by a self-adjusting arc stabilizing reactor. The reactor is to aid the operator in maintaining a steady arc on low as well as on high currents, under all welding conditions. For striking the arc, a high open-circuit voltage of 65 volts is available, after which the voltage is automatically reduced to that required to maintain the arc. Adjustments in the range of welding current, from 60 to 250 amperes, are made by shifting the generator brushes by means of an external handle. Further adjustment down to 25 amperes is made by shifting electrode leads.

The Clark trucwelder

The Trucwelder conforms to the specifications of the U. S. Bureau of Standards, meets the requirements of the United States Navy Department for arc welders and is listed as standard by the Underwriters Laboratories.

Internally-Tripped Landex Head

THE internally-tripped Landex head shown in the illustration, is a recent development of the Landis Machine Company, Waynesboro, Pa. The internal tripping attachment makes the head applicable for close-to-shoulder threading on work which varies in length and on work where a uniform length of thread is required. It is also adaptable for threading operations where a fixed stop cannot be used to open the die head, or where the work is held loosely in a fixture, as on a drill-press table.



The Landex internally-tripped die head, showing the plunger removed

The tripping mechanism consists of a plunger held in the shank of the head, the shank being drilled and tapped to accommodate it. The plunger is adjustable and can be set to any thread length within the capacity of the head. When used on automatic screw machines, it eliminates the necessity of accurate timing of the head-opening cam as the head is positively tripped when the end of the work comes in contact with the tripping plunger.

This head, when used on a machine such as a drill press, eliminates the necessity of chucking, a socket or floating fixture being used to hold the work.

It is made in sizes for threading from 3/16 in. to 2 in. in diameter and is particularly suited for the threading of parts such as pipe plugs, pipe bushings, bolts, screws, etc., where the thread length remains the same and where the part must be threaded close to a shoulder on the work.

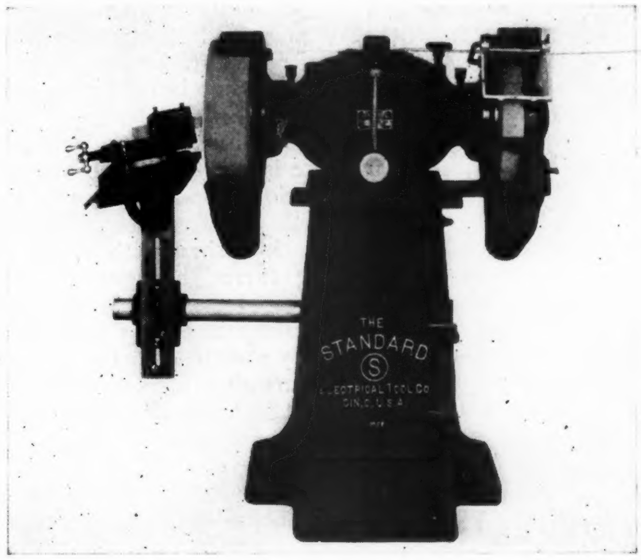
The Standard Tungsten-Carbide Tool Grinder

A DIRECT-motor-driven tool-bit grinder developed especially for the reconditioning of the edges of tungsten-carbide tools has been placed in the grinding field by The Standard Electric Tool Company, Cincinnati, Ohio.

The machine has a unique type of tool-bit holder. The tool is held rigid with set screws in a radial member, which has forward micrometer adjustment by means of a screw and ball crank. The radial member is graduated at the base to insure precision in grinding various angles. Rake is adjusted in a 90-deg. slot in the base of the attachment; this also is graduated. A vertical position is attained by sliding the entire attachment in a long slot in the vertical member. Horizontal adjustment is made by sliding a knuckle joint on a bar to compensate for the wear of the wheel. The top member or tool holder is moved by hand across the face of the wheel; however, the travel of this member is controlled by a slot in the base.

This type of grinder is almost entirely mechanically controlled. Angle, rake and cut can be set before starting the machine to prevent unnecessary tool waste in grinding. It is powered by a 3-hp. G. E. 40-deg. motor which has a heavy nickel-steel spindle operating on SKF ball bearings. It is also equipped with a magnetic starter and push-button control. It can be furnished with a coarse wheel for rough grinding on one side and a fine wheel for finishing on the other side, or as a combination tool and general grinder.

Wheels are of the cup type and are 14 in. by 4 in., by 1½ in. face. The height of the machine from the

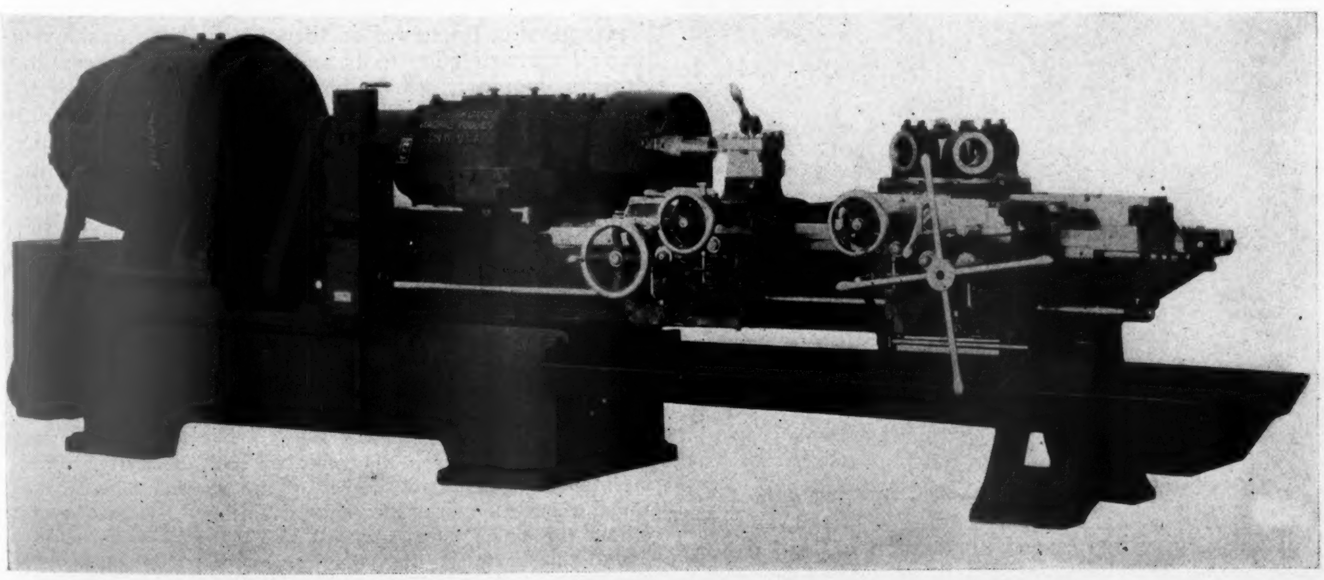


The Standard grinder for use on tungsten-carbide tools

floor to the center of the spindle is 37 in. and the total weight of this two-wheel standard grinder is approximately 809 lb.

Lathe for Tungsten-Carbide Cutting Tools

THE turret lathe shown in the illustration was developed by the Acme Machine Tool Company, Cincinnati, Ohio, so that the maximum benefits could be obtained from the use of tungsten-carbide cutting tools in machining phosphor bronze bearings. It is a combination of the Duo-Control turret lathe with special drive. A 25-hp. adjustable-speed motor connected directly to the spindle by flexible coupling is used to eliminate intermediate gearing and to supply a steady flow of power. Full-load spindle speeds of 300 r.p.m. to 1,200 r.p.m. are obtained, which are adjusted by means of rheostats, one of which is of the vernier type for the finer adjustments. Starting, stopping and braking is controlled electrically.



The Acme turret lathe designed for using tungsten-carbide cutting tools

The Acme standard roller-bearing spindle, having the double set of Timken bearings on the nose end, with a floating rear roller bearing, is used on account of the high speeds at which the machine is designed to run. A positive lubricating system is provided for the spindle bearings. The oil pump which passes the lubricant through a Purolator is driven by a constant-speed motor which also drives the turret quick motion.

Twelve independent reversible feed changes are provided for each carriage, all of which are located in their respective aprons. This arrangement is used to eliminate scattered control levers. The feed changes are made by means of sliding gears mounted on squared shafts, which, in turn, revolve in anti-friction bearings. The mechanism is entirely enclosed and revolves in an oil bath.

The main carriage can be furnished with either a fixed center or cross sliding turret, hexagon or flat type being optional. Power rapid traverse is also incorporated for longitudinal movement of this unit. The square turret carriage is rigidly mounted on both front and rear vees of the bed to furnish a firm support for tooling. Regular engine-lathe taper and chasing attachments can be furnished.

An All-Electric Spraying Outfit

THE Metal Specialties Manufacturing Company, 338 North Kedzie avenue, Chicago, has placed on the market an all-electric portable spraying outfit which has been designated as Presto model 155. The outfit is

The Presto Model 155 all-electric spraying outfit

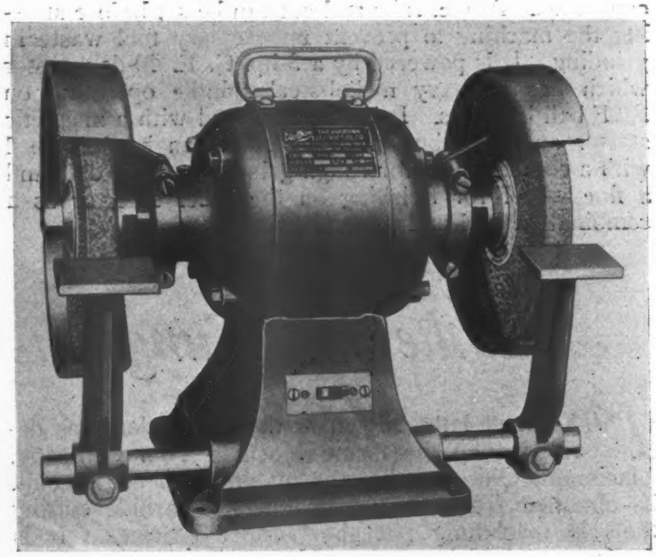
designed to give high speed application of lead paints, enamels and other heavy materials, as well as oil paints, lacquers, shellacs, varnishes and bronzes. The nozzle design atomizes these liquids internally to eliminate excessive fog and mist.

A needle-valve adjustment, controlled from the trigger, enables the operator to regulate the size of the spray and the amount of material applied. The operator can also blow air through the gun to remove dust and foreign matter from the surface about to be sprayed.

In addition, the direct drive from motor to compressor makes the outfit practically noiseless and vibrationless in operation. There are no gears, belts or pulleys. The outfit is furnished complete with interchangeable caps for round or fan spray, two air filters, three seamless containers, 25 ft. of electric cord and 25 ft. of air hose.

Portable Bench Grinder

TO complete its line of portable grinders, the Van Dorn Electric Tool Company, Cleveland, Ohio,



The 7-in. Van Dorn grinder

has announced a new 7-in. bench grinder for sharpening all sorts of edge tools and for other light grinding. It is a compact, sturdy ball-bearing grinder with the ball bearings mounted in dustproof housings, and is vibrationless at all speeds, due to its dynamic balance. It is furnished complete with grinding wheels, adjustable tool rests, wheel guards, switch and cable, and is available for all voltage and currents.

WHILE MAKING EXCAVATIONS for a new center pier for a bridge across Bush river, near Newberry, S. C., on the Columbia-Greenville line of the Southern, construction forces struck an obstruction about six feet below the bed of the stream. This was found to be an old, frame box-car which had gone into the stream approximately 50 years ago. It was necessary to remove the car before the cofferdam could be carried to bedrock, about 12 ft. below the bed of the stream. The car was found to have contained merchandise. Several bottles of sperm oil and turpentine were recovered, also two quarts of a strange liquid which formerly moved in commerce but which none of the members of the bridge force could recognize, either by taste or aroma.

Among the Clubs and Associations

THE SECOND ANNUAL CONVENTION of the Master Car Builders' and Supervisors' Association will be held in the Crystal ballroom of the Book-Cadillac hotel, Detroit, Mich., Tuesday, Wednesday and Thursday, August 26, 27 and 28, 1930. The program is as follows:

TUESDAY, AUGUST 26

10:00 a.m.—Opening exercises
Address by President C. J. Wymer, superintendent of the car department, Chicago & Eastern Illinois

10:30 a.m.—Address by R. H. Aishton, president, American Railway Association

11:00 a.m.—Address by T. C. Powell, president, Chicago & Eastern Illinois

11:30 a.m.—Report of Secretary-Treasurer A. S. Sternberg, master car builder, Belt Railway of Chicago.
Report of Membership Commitee and presentation to the winner of the prize awarded for securing the largest number of new members during the past year, by Vice-President F. A. Starr, supervisor of reclamation, Chesapeake & Ohio

2:00 p.m.—Report of Advertising Committee by Chairman H. A. Sigwart, Missouri Pacific

2:20 p.m.—Individual paper on How Can the Mechanical Departments of the Railroads Improve the Service Rendered to Private Line Cars, by J. C. Scheidel, district superintendent of car repairs, North American Car Corporation

3:00 p.m.—Report of Committee on Wheel Failures, by Chairman W. J. McClennan, general shop inspector, New York Central

3:40 p.m.—Individual paper on Systematic Repairs to Freight Cars, by W. E. Dunham, superintendent of the car department, Chicago & North Western

4:20 p.m.—Report of Billing Section, A. R. A. Rules, E. S. Swift, chief A. R. A. clerk, Wabash

WEDNESDAY, AUGUST 27

9:00 a.m.—Address by C. R. Megee, district manager, A. R. A. Car Service Division

9:30 a.m.—Address on Bureau of Explosives Rules, by W. S. Topping, representing the bureau

10:15 a.m.—Open discussion of A. R. A. loading rules, to be led by M. E. Fitzgerald, general car inspector, Chicago & Eastern Illinois. During the discussion E. Dahill, chief engineer of the A. R. A. Freight Container Bureau, will present some moving pictures dealing with the subject.

11:00 a.m.—Report of A. R. A. Committee and discussion of A. R. A. interchange rules, Chairman M. E. Fitzgerald, general car inspector, Chicago & Eastern Illinois

1:30 p.m.—Continued discussion of A. R. A. Rules

3:15 p.m.—Report of Committee on Formulation of a Standard Method of Selecting Cars for Commodity Loading; Recommendation of a standard and conspicuous commodity card to indicate the commodity for which the car is suitable

4:00 p.m.—Open discussion to be participated in by all chief interchange inspectors on reasons for local interchange agreements deviating from the A. R. A. interchange rules

THURSDAY, AUGUST 28

9:00 a.m.—Address on Safety, by W. S. Smith, safety department, Ford Motor Company

9:30 a.m.—Individual paper on Air Brakes, by C. R. Childs, air brake supervisor, New York, Chicago & St. Louis

10:00 a.m.—Individual paper on Draft Gears, by E. J. Robertson, superintendent of the car department, Minneapolis, St. Paul & Sault Ste. Marie

10:45 a.m.—Individual paper on Relations between the Car and Stores Departments, by F. E. Cheshire, general car inspector, Missouri Pacific

11:15 a.m.—Report of Committee on Elimination of Oil and Grease from House Cars and Reduction in Freight Claims Generally, by W. T. Westall, special assistant to superintendent of rolling stock, New York Central

1:30 p.m.—Report of Auditing Committee

1:35 p.m.—Report of Nominating Committee, E. H. Weigman, chairman

1:45 p.m.—Open discussion on A. R. A. Rule 66

2:30 p.m.—Report of Committee on Elimination of Damage to Automobile Car Floors by Automobile Shippers, Chairman M. J. Mills, master car builder, Pere Marquette

3:15 p.m.—Election of officers and closing business.

Club Papers

A. R. A. Loading Rules

Railway Carmen's Club of Peoria and Pekin.—Meeting held in room 38, Union station, Peoria, Ill. on May 20, 1930. ¶ The Railway Carmen's Club of Peoria and Pekin opened its meeting on May 20 with a discussion of the A.R.A. Interchange Rules. This discussion centered around two applications of Rules 32 and 44. The conclusion arrived at was that a statement to the car owner as to the existence of the old defects is sufficient to place responsibility with the car owner provided, after investigation it was found that the car was not subjected to unfair handling as outlined in Rule 32. In each instance, damage done to a car must be thoroughly investigated and a statement furnished the car owner showing how the damage occurred. ¶Another question brought up was that of accepting in interchange cars loaded with automobiles, or gasoline-operated equipment, placed in the car with gasoline remaining in the tanks. Should such loads be accepted in interchange and if so should they be protected with inflammable placards? The answer was given thus: "Bureau of Explosives, pamphlet No. 9, paragraph 308, section E, reads as follows: Automobiles, motorcycles, tractors or other self-propelled vehicles, equipped with acetylene gas cylinders, or gasoline or other fuel tanks securely closed, are exempt from label certificate and placard requirements." ¶ The remainder of the meeting was devoted to the reading and discussion of the general A.R.A. requirements for loading materials.

Value of a Trained Mind

Eleventh Annual Industrial Conference at Penn State.—The Pennsylvania State College held its eleventh annual industrial conference, May 15 to 17, inclusive. ¶ This conference was featured by the dedication of a new engineering building. C. E. Denney, president, Erie, presided at the annual dinner which was held Friday evening, May 16. L. K. Sillcox, vice-president, New York Air Brake Company, and William Elmer, special engineer, Pennsylvania, were among those who spoke at the dedication of the new engineering building. ¶ The subject of Mr. Sillcox's address was "The Value of a Trained Mind." "Man with his limited vision and his desire for knowledge," Mr. Sillcox said, "revels in speculation on his future. Most of us being dreamers, love to reflect upon what will be; we are awed and frequently chagrined and surprised by what actually happens. All of which proves the old truth that many things in life which start out to be one thing, eventually turn out to be something else." ¶ Thousands of engineers, he pointed out, can design structures, calculate strains and stresses, prepare plans and specifications for machine tools and equipment, but the great engineer is the man who can tell whether or not a structure or the machine should be built at all, where it should be built, and when. It is the selfsame problem which engineers must face in deciding for their companies, at this very time, to what lengths they should go in their endeavors to advance their plans for improving standardized products and for the development of new products to supply the requirements of trade. ¶ In concluding his address, Mr. Sillcox quoted from a talk by Dr. J. S. Noffsinger, Washington, D. C., who said, "A man is worth four dollars a day from his neck down, but from his neck up he is worth ten to fifty dollars a day and this depends upon what his mind knows and what it can do. * * * A man with a great mind might lose his power of locomotion and yet not be greatly handicapped."

Teaching Steam Distribution

Southern and Southwestern Railway Club.—Meeting held in the Roof Garden, Hotel Ansley, Atlanta, Ga., May 15, 1930. The May meeting of the Southern and Southwestern Railway Club was featured by two papers, the first of which was on the subject "A Good Method of Teaching Steam Distribution and Valve and Cylinder Events," by John T. Gill, special instructor, Railroad Department, International Correspondence Schools, and a paper on the subject of "Diesel Engines and Their Application to Railroad Work," by T. C. Wurts, Westinghouse Electric & Manufacturing Company. ¶ Mr. Gill introduced his subject by pointing out that every ambitious railroad machinist or apprentice has a keen desire to learn to set the valves on a locomotive. There is nothing mysterious, he said, about the operations required, provided the person who desires to master the art first understands steam distribution, or the action of consecutive piston pressures. The subject of locomotive

valves and valve setting naturally follows. Mr. Gill defined in his paper the terms used in valve setting necessary to understand the movement of the valves and piston, such as mid-position, steam and exhaust edges of a valve, steam and exhaust edges of a port, steam lap, exhaust lap, exhaust clearance and lead. He then defined various valve and cylinder events and described the movement of the valves with the reverse lever as it should be described for a class of apprentices. The paper was not intended for experts, but for those who serve as apprentice instructors and for supervisors whose work required instruction in valve setting from time to time. ¶The paper which was presented by Mr. Wurts on the subject of oil-electric motive power for steam railroads, reviewed the developments of the internal combustion engine for locomotive purposes from 1890 up to the present time. In that year the Patton Motor Car Company built a car powered with a small gasoline engine and electrical transmission. A gasoline rail motor car having a mechanical transmission was built in Wurttemberg, Germany, in 1893 and a similar model was operated in Chicago in 1899. Mr. Wurts' paper was devoted largely to the contributions of the Westinghouse Company to the development of the internal-combustion locomotive. The latter portion of his paper was devoted to a detailed description of the 600-hp. oil-electric locomotive which was built by Westinghouse for the Long Island about two years ago.

Manufacturing Car Wheels

Car Foremen's Association of St. Louis. — Meeting held May 6, 1930, American Hotel Annex, St. Louis, Mo. ¶The May meeting of the St. Louis Car Foremen's Association was featured with a paper by G. E. Doke, president of the Association of Manufacturers of Chilled Car Wheels, on the subject "The Manufacturing and Inspection of Chilled Tread Car Wheels." The association of which he is the president, Mr. Doke said, is composed of 24 manufacturers in the United States and Canada which have 58 plants scattered from California on the west, to Boston on the east, north through Montreal and across Canada. The 58 association foundries are subjected to periodical inspections by foundry inspectors who are employed by the association. ¶The association has a completely equipped research laboratory in Chicago where experiments for the development of the design and manufacture of chilled car wheels are constantly under way. The essential condition, he said, in the chemical composition of chilled tread wheels is a balance between sulphur, silicon, carbon and manganese. Variations in these constituents must not disturb this relation. ¶Mr. Doke described the developments that have been made in recent years in the manufacture of chilled-tread car wheels. These developments, he said, have eliminated the cracked plate, as well as chipped rims. A check by the New York Central, which extended over a period of four years, he said, shows the average life of the chilled-tread car wheels to be 7.9 years.

Transportation and State-Craft

New York Railroad Club.—Meeting held in the Engineering Societies building, 29 West Thirty-Ninth street, New York, May 16, 1930. The Hon. Alben W. Barkley, United States Senator from Kentucky and a member of the Senate Committee on Interstate Commerce addressed the members of the New York Railroad Club on the subject of "Transportation and State-Craft." ¶Senator Barkley reviewed the development of legislation regulating steam railroad transportation. He said: "I think it is the desire of Congress, and I feel sure it is the desire of the committees which handle legislation of this sort, to deal justly and fairly with the people and with the railroads. All over this country, as we all know, there is a different feeling among the people toward the great transportation systems of our country from that which existed a generation or even a decade ago." ¶"At this time," he said, "Congress is confronted with the problem of regulating transportation of property and persons by motor bus in interstate commerce. There are some who oppose the provisions of the bill which passed the House a few weeks ago, on the ground it requires a certificate of convenience and necessity from the Interstate Commerce Commission before any man or group of men can establish a bus line between one state and another. So far as I am individually concerned," he said, "I believe that to be a fair requirement." Senator Barkley closed his remarks by paying a tribute of appreciation for the great service which has been rendered and is being rendered by the railroads of this country.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting, Sept. 9-11, 1930, Congress Hotel, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I.—SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago. Next meeting, September 10, 11 and 12, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

MACHINE SHOP PRACTICE DIVISION.—Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY SUPPLY MEN.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

BOILER MAKER'S SUPPLY MEN'S ASSOCIATION.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Association.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth street, Los Angeles, Cal. Meetings second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior avenue.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich. Next meeting September 23-25, 1930, Hotel Sherman, Chicago.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' SUPPLY MEN'S ASSOCIATION.—J. H. Jones, Crucible Steel Company of America, 650 Washington boulevard, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha street, Winona, Minn. Next meeting, September 16 to 19, inclusive, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY SUPPLY MEN'S ASSOCIATION.—L. R. Pyle, Locomotive Firebox Company, Chicago. Meets with International Railway Fuel Association.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKER'S ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago. Next convention August 26-28, Book-Cadillac Hotel, Detroit.

NATIONAL SAFETY COUNCIL.—STEAM RAILROAD SECTION: W. A. Booth, Canadian National, Montreal, Que. Annual congress, September 29-October 4, William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately.

PUEBLO CAR MEN'S ASSOCIATION.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

RAILWAY EQUIPMENT MANUFACTURERS' ASSOCIATION.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md. Next meeting October 21-23.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

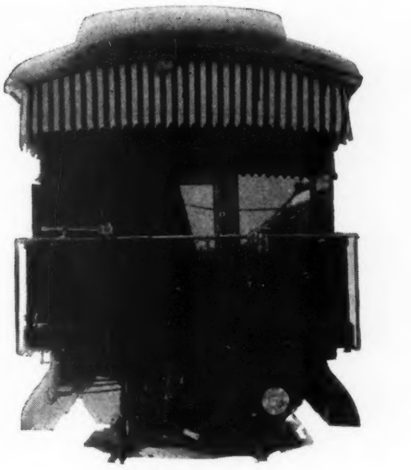
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION.—E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

SUPPLY MEN'S ASSOCIATION.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Master Car Builders and Supervisors' Association.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio. Next meeting September 23-26, 1930, Hotel Sherman, Chicago.

NEWS



The Chesapeake & Ohio has awarded a contract to the Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., for the construction of a water-treating station at Seth, W. Va.

The Pennsylvania has awarded a contract for the construction of a four-track reinforced concrete automatic electric coaling station of 500-ton capacity at the West Philadelphia (Pa.) shops to the Roberts & Schaefer Company, Chicago.

Charles D. McCall has been placed in charge of sales of Putnam machine tools in the Detroit territory of Manning, Maxwell & Moore, Inc. Mr. McCall's headquarters are in the General Motors Building, Detroit.

The Elgin, Joliet & Eastern has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 300-ton two-track coaling station with coal crushing facilities, at Ingalton, Ill.

The twelfth annual National Metal Exposition, including the annual meeting of the American Society for Steel Treating and other features of the National Metal Congress, will be held at the Stevens Hotel, Chicago, September 22-26, inclusive.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract for the construction of a repair shop building, 184 ft. by 444 ft., at Beech Grove (Indianapolis), Ind., to the Ellington-Miller Company, Chicago. The building will involve an expenditure of about $160,000.

The Atchison, Topeka & Santa Fe has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of coal, sand and water facilities at Las Vegas, N. M. The facilities will be arranged so that a locomotive may be supplied with all three materials at one time.

The Lehigh Valley has awarded a contract for the construction, at Manchester, N. Y., of a water softener with softening capacity of 68,000 gal. per hour and a storage capacity of 150,000 gal. to the Graver Tank & Manufacturing Corporation, East Chicago, Ind. The settling tank will be 47 ft. in diameter by 49 ft. high.

The Chicago, St. Paul, Minneapolis & Omaha has awarded a contract to the Graver Tank & Manufacturing Corporation, East Chicago, Ind., for the construction of a water softener at Mankato, Minn., which will have a softening capacity of 35,000 gal. per hour. The settling tank will be 31 ft. 6 in. in diameter by 62 ft. high and will have a storage capacity of 185,000 gal.

The Commonwealth Division of the General Steel Castings Corporation, Granite City, Ill., has begun work on the integral casting of 25 locomotive beds, each of which will weigh 82 tons and will be 60 ft. 1 in. long. They will be sent to the American Locomotive Company's plant at Schenectady, N. Y., where three-cylinder locomotives will be built for the Union Pacific.

The Chicago, Rock Island & Pacific has awarded a contract to Arthur H. Neumann, Des Moines, Iowa, for the construction of a 10-stall addition to the enginehouse, a new storehouse and a new enginehouse office, all of which will be built of brick, at East Des Moines, Iowa. A contract for the construction of a water-treating plant at the same point has been awarded to the Railroad Water & Coal Handling Company, Chicago.

Wage Statistics for March

The number of employees reported to the Interstate Commerce Commission by Class I steam railways as of the middle of March was 1,546,663 and the total compensation was $227,066,435. Compared with the returns for the corresponding month of last year the summary for March shows a decrease of 81,725 in the number of employees, or 5.02 per cent, and a decrease of $14,083,342, or 5.84 per cent, in the total compensation.

The Transit Air Brake—A Correction

An article appeared in the May issue of the *Railway Mechanical Engineer*, page 251, describing the Transit air brake which was being tested in Sweden. The tests referred to in the article were not made under the auspices of the Swedish State Railways and were therefore not official. The tests were made under the supervision of the inventor and the manufacturers of the air brake on several privately owned railroads in Sweden. The Swedish State Railways use the Kunze-Knorr-brake and the tests of the Transit brake have not as yet been officially approved.

N. S. C. Plaques

The National Safety Council has awarded plaques to the railroads having the best safety record during 1929 as follows:

Group A (100 Billion Man-Hours or More)—Union Pacific System.
Group B (50 to 100 Billion Man-Hours)—Union Pacific Company.
Group C (20 to 50 Billion Man-Hours)—Oregon-Washington Railroad & Navigation Co.
Group D (10 to 20 Billion Man-Hours)—Los Angeles & Salt Lake.
Group E (5 to 10 Billion Man-Hours)—Gulf, Mobile & Northern.
Group F (2 to 5 Billion Man-Hours)—Duluth & Iron Range.
Group G (Less than 2 Billion Man-Hours)—Conemaugh & Black Lick.
Group H (Pullman Company Zones)—Chicago Central Zone.

Pensions on Central of Georgia

The Central of Georgia in 1929 retired on pension 39 employees, 20 of whom had not reached the age of 70, but were retired because of physical incapacity. This road has paid pensions since 1913, disbursing thereon a total of $541,816. There are now on the rolls 155 pensioners, who receive an average of $49.13 a month, or $589.56 yearly. This is equivalent to the interest on Central of Georgia bonds with a market value of more than $12,000. To have accumulated this sum the pensioned employee would have had to save an average of $350. for each year he was in active service. Under this pension system, each year of service is equivalent to the payment of a premium on an endowment insurance policy.

Great Northern Officers Participate in Reorganization of Soviet Railway

At the invitation of the Commissariat for Transportation of the U. S. S. R., Ralph Budd, president of the rGeat Northern, and several members of this staff are in Russia to aid in the reorganization of the Soviet Railway system by giving advice in matters concerning railroad transportation, especially as regards more rational methods of exploitation,

better use of rolling stock, improved methods of repairing rolling stock, the most suitable types of locomotives and freight cars, technical standards, and the most effective and economical methods to be used in constructing new railway lines. W. R. Wood, mechanical engineer of the Great Northern, is studying the motive-power needs of the Soviet Railways.

The Divided Basket Bunker vs. Brine Tanks in Refrigerator Cars

Transportation Circular No. 47, which was issued recently by the Department of Agriculture, Fruit Branch, Dominion of Canada, gives the results of an investigation of the respective merits of divided basket bunkers and brine-tank refrigerator cars made during the past winter. Comparative tests were made with heated lading during the month of February, 1929. The two cars used in the test described in the circular were loaded with potatoes at separate points on Prince Edward Island. Inside temperatures were observed with six electrical resistance thermometers which were installed in each car from Borden, P. E. I., and Moose Jaw, Sask. A chart is included with the circular which shows the average floor and top-load temperatures between these two points.

Car Ownership and Standardization Discussions in Britain

The Federation of British Industries has recently issued a statement setting forth its position in connection with present discussions of ownership, pooling and standardization of freight cars in service on railways of Great Britain. A statement of the railways in this connection was made in a recent issue of Railway Newsletter, official publicity pamphlet of the British Railways Press Bureau, and summarized in the *Railway Age* of November 30, 1929, page 1307.

The statement of the federation summarizes its position under three heads. As to the present system of car ownership the federation "is definitely of the opinion that the present system of car ownership should be continued on the ground that there is no adequate evidence that the abolition of private ownership would confer any appreciable benefit on any branch of industry. On the contrary, there is much evidence which would tend to show that it would create not only greater cost of transport of coal, but a shortage of cars for mineral traffic and consequent dislocation of trade."

On the question of pooling, the findings of the federation are that "the creation of compulsory pools would result in the operations of the collieries being practically controlled by the railway companies, or other controlling body . . . . It would deprive the colliery owner of the disposition of its cars and he would be at the mercy of the railway companies or other controlling body as to the number of cars supplied and when supplied."

On the third point, the standardization of cars, the federation finds that complete standardization of rolling stock must be preceded by the standardization of railway terminals and other facilities for the handling of such standardized equipment.

Lackawanna Tests Multiple Unit Cars

At Erie, Pa., on May 27, officers of the Delaware, Lackawanna & Western, the General Electric Company, and Jackson & Moreland, consulting electrical engineers of Boston, Mass., witnessed tests of the first two-car unit for the electrified commuter service of the Lackawanna between New York City and northern New Jersey. Powered by four 230 hp. (1 hour rating) motors and using the 3,000 volt direct current system for the first time in multiple unit service in the United States, the train, consisting of one motor car and one trailer, attained a speed of 71½ miles per hour, with an acceleration of 1½ miles per second. In emergency operation tests, the electro-pneumatic brakes brought the train to a stop in exactly 2/10 of a mile from a speed of 56 miles per hour.

Work is to be rushed with all practicable speed on 140 additional two-car units, each seating 166 passengers. When finished, they will be used in trains of 2, 4, 6, 8 and 10 cars, as necessary to accommodate the traffic moving. Barring unforeseen delays the Lackawanna multiple unit suburban service is to be in operation between Hoboken, N. J., Montclair and the Oranges by mid-September, Morristown and Dover by mid-December and Gladstone on or about January 1, 1931.

Historical Bulletins

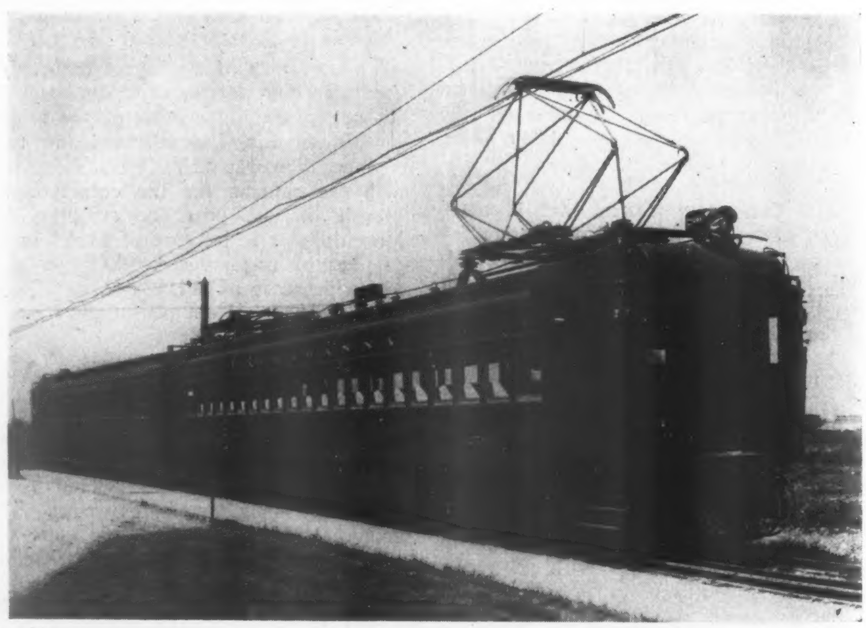
Bulletin No. 21 of the Railway & Locomotive Historical Society (Harvard Business School, Boston), dated March, 1930, No. 21, is devoted wholly to an account of the Philadelphia, Wilmington & Baltimore Railroad. This road, organized February 5, 1838, as a consolidation of three earlier corporations, was acquired by the Pennsylvania in 1881; and this historical sketch ends with the latter year. It is made up, chronologically, of abstracts from the company's annual reports for the successive years. One of the earliest chapters tells of controversies with the government concerning the price to be paid for the transportation of the mails, and interesting experiments with coal-burning locomotives and in the construction of track and bridges are noted. Lists of locomotives owned constitute a leading feature.

In 1859, two long passenger cars were fitted up to be used as sleeping cars between Philadelphia and Washington (hauled through Baltimore by horses).

The road took credit for being a pioneer in the use of railway mail cars, apparently ignorant of the fact there had been other "pioneers."

In 1877, the engineer, S. T. Fuller, began keeping records of the life of rails in the track. In 1879 the use of horses for drawing passenger cars through the streets of Baltimore (en route to and from Washington) was discontinued and cars were transferred by boat across the harbor between Canton and Locust Point. At the end of 1879, 25 miles of road had tracks ballasted with stone.

The frontispiece of the pamphlet is a portrait of Samuel F. Felton, who was president from 1851 to 1863. Other illustrations show three types of locomotives and the station buildings at Philadelphia and Baltimore.



The first motor car and trailer unit to be tested for the Delaware, Lackawanna & Western's electrified suburban service in Northern New Jersey

Supply Trade Notes

The Superheater Company has moved its offices from 17 East Forty-Second street to the Lincoln building, 60 East Forty-Second street, New York.

Richard F. Straw has been appointed sales manager of the Wright Manufacturing Company, Bridgeport, Conn.

A. H. Purdom has resigned from the railroad sales department of the Wood Conversion Company, Chicago, and will open an office to handle railway supplies.

Benjamin B. Shaw has been appointed sales representative in the railroad department of the Wood Conversion Company, with headquarters at Chicago.

The G. M. Basford Company has moved its offices from 17 East Forty-Second street to the Lincoln building, 60 East Forty-Second street, New York.

Benjamin Nields, Jr., sales agent for the National Malleable & Steel Castings Company, has moved his office from 17 East Forty-Second street to the Lincoln Building, 60 East Forty-second street, New York.

Robert S. Hammond, district manager of the Chicago district for the Whiting Corporation, Harvey, Ill., has been appointed sales manager of that company. R. E. Prussing, vice-president at Cleveland, Ohio, has been transferred to Chicago in charge of the office in that city. R. H. Moore has been appointed district manager at Cleveland. Mr. Hammond has been connected with the Whiting Corporation for 11 years. He graduated from a course in mechanical

Robert S. Hammond

engineering at the University of Michigan in 1911 and gained his first business experience with the American Steel Foundries at Granite City, Ill. Two years later he entered the sales department of that company at Chicago, first in the railway specialty sales department and then as a sales agent. Mr. Hammond was placed in charge of the Pittsburgh (Pa.) territory of the Whiting Corporation in 1919, and in 1921 he was appointed district manager of the Chicago district for that company. Mr. Moore has been connected with the company since 1926. Prior to his employment at that time Mr. Moore served with a num-

Ray H. Moore

ber of foundry equipment manufacturers, specializing in the development of cleaning room equipment. As manager of foundry equipment with the Whiting Corporation, he has been engaged in the design and development of foundry equipment, including tumbling mills and dust filters.

H. S. Schroeder, formerly vice-president and general sales manager of the Interstate Iron & Steel Company, has been appointed western manager of sales for the Republic Steel Corporation, with headquarters at Chicago.

J. E. Gardiner, general air brake inspector of the Boston & Maine, has

J. E. Gardiner

resigned to become a sales representative for the Gustin-Bacon Manufacturing Company, with headquarters at Philadelphia, Pa. Mr. Gardiner was born on May 23, 1888, at St. Johns, N. B. At the age of sixteen he entered the employ of the Boston & Maine as a locomotive fireman, and in 1916 was promoted to the position of engineman. Six years later he became an air brake instructor, serving in this capacity for two years. He was acting master mechanic at Springfield, Mass., for three months, and in 1923 was appointed general air brake inspector. Mr. Gardiner has been an active member of the Air Brake Association for many years. For the past two years he has served on the Executive Committee.

The Symington Company and the Gould Coupler Company have opened a sales office at 1815 Terminal Tower building, Cleveland, Ohio. Hynes Sparks, assistant vice-president of both companies, will be in charge of this office.

Tube-Turns, Inc., Louisville, Ky., has announced additions to its plant and equipment which it is expected will increase production by about 60 per cent. The addition to the factory has been completed and the new equipment will be ready for operation by August 1.

F. B. Archibald, vice-president of the National Lock Washer Company, Newark, N. J., with headquarters at 50 Church street, New York, has been transferred to 40 Hermon street, Newark, N. J., following the closing of the New York office.

R. E. Moore has been elected a director and vice-president of the Transportation Equipment Corporation, 230 Park avenue, New York. He will be in charge of the production and engineer work. Mr. Moore was born at Hornell, N. Y., on February 1, 1887. He attended the Hornell high school, and was graduated as an electrical engineer from the Pratt Institute and from Columbia University. He served as a first lieutenant in the Aviation Corps during the World War. His first railroad work was in the Hornell shops of the Erie and from 1907 to 1909 he served as chief electrician of the Erie, at Jersey City, N. J. He later worked with the General Electric Company and was power engineer of the New York & Queens Electric Light & Power Company from 1914 to 1917. In 1925 he was elected vice-president of Fischbach & Moore, electrical contractors, and while in this capacity he assisted in the design and supervised the installation of the electrical work in the Holland Tunnel, designed and supervised the electrical installation work in the New York Life Insurance building and also the charging system in the Railway Express Agency station at Sunnyside yards. He also supervised other large electrical installations including the new auditorium at Atlantic City, Erie shop at Susquehanna, Pa., Buffalo terminal of the New York Central, Sunnyside yards of the Pennsylvania, and the New York Central station at Erie, Pa.

Personal Mention

General

R. H. FLINN, general superintendent of motive power of the Central Region of the Pennsylvania, has been appointed general superintendent, Western Pennsylvania division, with headquarters at Pittsburgh, Pa., succeeding J. H. Redding, deceased.

LEWIS D. FREEMAN, assistant to chief mechanical officer of the Chesapeake & Ohio, with headquarters at Richmond, Va., who has been promoted to assistant superintendent motive power at Huntington, W. Va., was born on July 11, 1888, at Gettysburg, Pa., and commenced his business career with the Baldwin Locomotive Works in 1905. In

Lewis D. Freeman

June, 1910, he entered railway service with the Baltimore & Ohio as draftsman in the office of the mechanical engineer and continued his connection with this road until December, 1912, when he accepted a position as chief draftsman with the Kansas City Southern at Pittsburg, Kan. In February, 1914, he entered the service of the Seaboard Air Line as shop superintendent at Portsmouth, Va., and in October, 1919, he was promoted to assistant superintendent of motive power, with the same headquarters. From April, 1924, until his recent promotion he held the position of assistant to chief mechanical officer of the Chesapeake & Ohio at Richmond, Va.

Car Department

R. E. BAKER has been appointed general air brake inspector of the Boston & Maine, with headquarters at Boston, Mass., succeeding J. E. Gardiner, resigned.

HARRIE E. MYERS, master mechanic of the Lehigh Valley, with headquarters at Buffalo, N. Y., has been appointed master car builder with headquarters at Bethlehem, Pa. Mr. Myers was born at St. Joseph, Mo., and in 1897 he began his railway career in that city with the Chicago, Burlington & Quincy. After serving his regular apprenticeship he continued in the service of this road until 1903 when he became associated with the Union Pacific for a period of over two years. While with the Union

Harrie E. Myers

Pacific he served in various capacities in the mechanical department. In July, 1905, he became general machine foreman of the Atchison, Topeka & Santa Fe at Fort Madison, Iowa. In 1906, he accepted the position of shop inspector with the Lehigh Valley at Sayre, Pa. He was appointed assistant master mechanic at Easton, Pa., in 1912 and shop superintendent of the Packerton, Pa., car shops in 1913. From 1914 until his recent promotion, Mr. Myers served as master mechanic at Auburn, N. Y., Hazleton, Pa., and Buffalo, N. Y.

Master Mechanics and Road Foremen

G. T. CALLENDER has been appointed master mechanic of the Joplin and White River divisions of the Missouri Pacific, with headquarters at Nevada, Mo.

MENDELL A. KINNEY, who has been appointed general master mechanic of the Chesapeake & Ohio, with headquarters at Columbus, Ohio, was born on August 2, 1872, at Monroe, Ashtabula County, Ohio. He received a high school education and on October 1, 1888, became a machinist apprentice on the New York, Chicago & St. Louis. He served as an air brake instructor from 1892 until 1893; as a gang foreman at Chicago from 1893 to 1897; as machine shop foreman from 1897 to 1903, and as enginehouse foreman at Ft. Wayne, Ind., from 1903 to 1904. On February 1 of the latter year he was appointed general enginehouse foreman of the Baltimore & Ohio at Newark, Ohio, and on April 1, 1907, became general shop foreman of the Hocking Valley at Columbus, Ohio. He was promoted to the position of master mechanic on April 1, 1907, and to the position of superintendent motive power on October 1, 1910. He now becomes general master mechanic of the Hocking and Chicago divisions of the Chesapeake & Ohio.

Purchases and Stores

C. A. SLATER, acting assistant purchasing agent of the Canadian Pacific, has been appointed assistant purchasing agent at Quebec, Que.

J. ARNOTT, assistant purchasing agent on the Canadian Pacific at Calgary, Alta., has been transferred to Winnipeg, Man., succeeding C. A. Slater.

R. H. YARNELL, assistant purchasing agent of the Canadian Pacific, at Quebec, Que., has been transferred to Calgary, Alta., replacing J. Arnott.

R. E. COCHRUN, storekeeper of the Oklahoma division of the Atchison, Topeka & Santa Fe at Arkansas City, Ark., has been transferred to the Middle division, with headquarters at Newton, Kan.

A. J. BAKER, storekeeper of the Western division of the Atchison, Topeka & Santa Fe at Dodge City, Kan., has been transferred to the Oklahoma division, with headquarters at Arkansas City, Ark., succeeding R. E. Cochrun.

Obituary

A. L. GREENABAUM, vice-president O. F. Jordan Company, East Chicago, Ind., died at Chicago on June 4 after an extended illness.

ROBERT BRUCE STEWARD, a vice-president and director of the Valve Pilot Corporation, New York, since its organization, died on May 17.

J. L. ROWE, manager of railroad sales of the Chicago Pneumatic Tool Company, New York, died on June 5 from injuries sustained in an automobile accident. Mr. Rowe had been with the company since 1919.

BOONE V. H. JOHNSON, sales agent of the General Steel Castings Corporation, Granite City, Ill., and formerly vice-president and sales agent of the Commonwealth Steel Company, died at Barnes hospital, St. Louis, Mo., on June 2, following an illness of ten weeks. Mr. Johnson had been connected with the Commonwealth Steel Company for 12 years.

LYLE H. RUPERT, service engineer of the Franklin Railway Supply Company, Inc., New York, died at El Paso, Tex., on May 29. Mr. Rupert had been a member of the Franklin service staff since September 1, 1923, operating in Texas, New Mexico, Arizona and Mexico. He also made an extended trip to South America in 1924 to supervise the installations of locomotive boosters and other Franklin devices on the Chilean State Railways, the Mogyana Railway of Brazil and the Brazilian State Railways.